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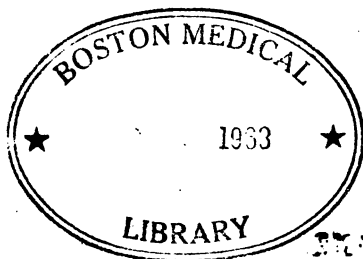
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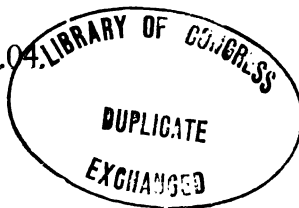
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FOREWORD.

In this volume, the third of its kind issued from our presses, we publish two articles with illustrations. As far as possible in the future the special hazard articles appearing each month in *THE WEEKLY UNDERWRITER* will be illustrated. The publishers bespeak for this volume the same hearty welcome which has been accorded its predecessors, and take opportunity here to thank the contributors who have made possible the publication of this book.

Of the preceding volumes, No. 1 contains articles on Cotton Mills, Clothing Factories, Soap Factories, Metal Workers, Paint and Varnish Factories, Brickyards, Patent and Enameled Leather Risks, Candy Factories, Breweries, Fur Industry, Storage Warehouses. Theatres and the Tobacco Industry. Volume 2 contains three additional chapters on Tobacco and articles on Flour Mills, Cabinet Factories, Garages, Fireproof Buildings, Sugar Refineries, Paper Mills, Hotels, Hat Factories and Printing and Its Allied Trades.

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TANNERIES AND LEATHER MANUFACTURING.*

Description of the Processes and Hazards of the Manufacturing and Finishing of Leather, With Illustrations of Machines Used Therein.

By Everett Nourse, Superintendent Sprinklered Risk Department, United States Branch of Northern Assurance Company, Ltd., of London.

The art of manufacturing hides into leather is centuries old, but only in the last few decades has the industry developed materially. The great progress shown and the present high standard are the result of improved methods and competition. Old machinery has been found inadequate and new machinery is in use which facilitates many of the processes, although a large percentage of the work is and perhaps always will be done by hand. Tanners have interested chemists in the manufacture of bark extracts, and as a result standard extracts are now on the market containing a fixed percentage of tannin. They tend to rapid tannage and are exceedingly popular. This has to a great extent done away with the bark mill, a source of frequent fires. However, one still meets with the bark grinding process in some sole leather and harness leather tanneries. Chrome tannage, a rapid process, has almost entirely superseded bark tanning for heavy and light skins. However, with all the materials and devices that have been invented tanning is essentially a slow process and cannot be forced through without injury to the product.

NATURE OF HIDES AND CLASSES.

For a better understanding of the processes of the tannery and leather finishing plant let us first consider the nature of animal hides. The hides of animals are composed of three layers—the epidermis or thin outer cuticle or skin to which the hair is attached, the corium or skin proper, and the fatty tissues forming the inner layer.

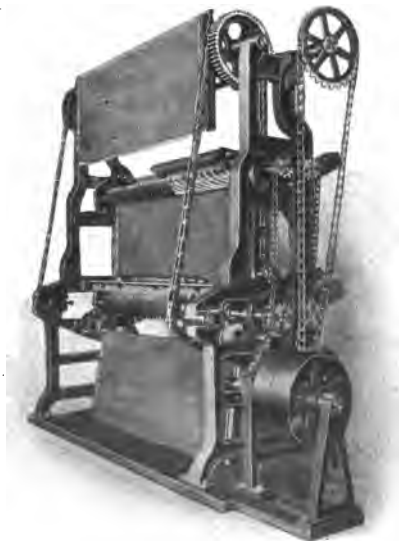
Pelts or hides are divided into three classes, and they are as follows: "Hides," or the skins of large animals, such as steer, ox, horse and cow. These are used in making heavy leather or sole leather, for belting, harness, shoe soles, strap and case leather, where strength, stiffness and wearing qualities are desired. "Kips," the hides of smaller animals of the same classes,

* The cuts used are furnished by courtesy of the Turner Tanning Machinery Company, of Peabody, Mass., and Newark, N. J.

and "skins," those obtained from calves, sheep and goats. There are a few chamois skins in the market, but only a few. The commercial chamois is made from split sheepskin, which will be spoken of later.

TANNING PROCESSES.

The hides are received at the tannery either dry or salted down, green salted, as it is termed, and right from the animal.



SERIAL TABLE UNHAIRING OR PUTTING-OUT MACHINE.

If dry, they are hard and stiff and must be softened up. After some trimming and hole punching they are sent to the "soaks."

SOAKING.

This soaking in vats of cold water renders them soft and pliable and removes salt, blood and dirt. They are left in "soaks" for, say, two days and are then ready for

LIMING.

The hides are now placed in vats containing a solution of slaked lime and worked about or left suspended from sides by ropes on pegs. The lime swells and loosens the cuticle, hair and fatty tissues. Hides are transferred to other vats contain-

ing stronger solution. This treatment covers a period which may vary a good deal, but is about three or four days' duration. Sulphide of sodium is sometimes used for quick work, but only on hides where the hair is of no value, as it is ruinous to the hair. When removed from the lime vats the hair and flesh are loose and the hide is ready for

BEAMING OR UNHAIRING.

The hair being thoroughly loosened it is scraped off, either by the unhairing machine shown in cut or by hand, with a blunt two-handled knife over a "beam" or sloping, rounded piece of wood. "Slating" consists in removing small particles left by the machine or "beamer."

"FLESHING."

may take place before or after "beaming," and consists in removing by machine or hand the fatty tissues clinging to the flesh side of the skin. After being trimmed the skin is thoroughly washed and "scudded," i. e., scraped again on a "beam" to remove surplus lime. Skins are now ready for bating. This process is not found in all tanneries.

BATING.

The lime bath leaves the skins or hides more or less swollen and causes them to become stiff and hard. In order to offset this effect and make the leather soft and smooth they are soaked in a bath of dog or hen manure and warm water. The effect of the lime is now counteracted by the bacteria which develop in this solution. Occasionally barn or lactic acid "drench" is used, and now a new solution of glucose is on the market. It is said that only a bacterial bath can give the softness and elasticity of grain combined with silkiness of texture which is wanted for most high grade leathers. This process is carefully watched and takes but a few hours. The skins are soft and pliable and ready to be converted into leather.

TANNING.

Now we come to the actual process of tanning. It is difficult to treat the subject properly, on account of the many different phases. There are three methods by which leather is prepared: First, and by far the most important, with tanbarks, bark extracts and other vegetable substances containing tannin; second, by tawing with alum or bichromate of potash and other mineral salts, and, third, by shamoying or impregnating the raw skin with oil.

The "modus operandi" varies endlessly and depends entirely on the nature of the hides or skins handled and the use for which they are intended. We will first consider the

TANNING OF HEAVY HIDES,

such as ox, horse, cow and steer. These require a vegetable tannin. Bark extracts are used to a very great extent. Formerly tanners ground their own bark to prepare their leaches. Now bark mills or grinders are met with only occasionally, and then in heavy hide tanneries near the source of the bark supply.

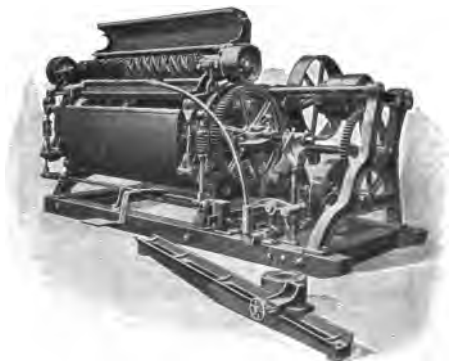


BARK MILL.

The principal barks are hemlock and oak. They are ground in a mill, shown in illustration, then dissolved in the leaches and solution usually pumped to storage tanks in yard and from there fed by gravity to tan pits. Oak, hemlock, chestnut and quebracho trees provide the principal bark extracts. Quebracho is a wonderful tanning agent of comparatively recent use. It is extracted from the wood and bark of a tree growing in Central and South America. It is said one ton of solid extract equals ten tons of bark, and is much cheaper. Extract will shorten the time of tanning and produce a better filled and firmer leather, somewhat lighter and brighter in color. In the beam house one finds a series of pits (large wooden vats sunk below the floor level) into which the hides or skins are deposited in layers or hung on "rockers" by ends and rocked to and fro in the tanning liquor by machinery. In the first pit or pits a spent solution from a previous lot or batch is used, so that the action of the tannin will have a uniform effect all over the hide. Strong solution at first would tend to tan in spots. The hides are frequently

handled and are transferred to the next tanks in series where, as tanning proceeds, liquor is made increasingly rich and strong. After a space varying in length from four or five days to one or two months, depending on the tanning agent and the thickness and quality of the hides or skins, tanning is complete. As an example of progress the writer recently handled an elephant hide which when split was tanned and finished in ten days. When removed from liquor hides are drained and sent to a loft for drying. If thick and heavy, hides are often split and retanned. In the dry room they are either hung up on poles or tacked on boards in racks and dried by warm or cold air blower system or by ordinary steam pipe arrangement at sides and centre of loft. When dry, hides or skins are piled in bundles, sorted and sent to currying and finishing rooms. In smaller tanneries working light skins one will find only a few tan pits. These people use sumac or chrome salts. There are a few dealers who buy sheep and goat skins pickled in casks, usually from abroad, and thus avoid the preliminary processes.

Other vegetable tannins are gambier, extracted from the leaves of an East Indian tree, and sumac, the powdered leaves and



DRUM MACHINE.

bark of that common tree. These are both quick tanning agents used on lighter skins, such as goat, sheep and calf.

MINERAL TANNINS.

are not used on heavy hides, but for calf, sheep and goat skins. Chrome tannage is a very popular method. It is rapid but costly, and particular care must be exercised in preparing the liquor. Skins, having been treated in the usual preliminary processes of soaking, liming, beaming and bating (or perhaps

only soaking in brine is required) are placed in drums or tanks in a solution of bichromate of potassium (a pink crystalline salt) to which salt or sulphuric acid in certain quantities may or may not be added. They are worked about for a few hours, drained and placed again in a bath of sodium bisulphate, washed clear and dried. When salt, alum, potassium bichromate or any other mineral tannin is used the process is called "tawing." The salts cure the skin and the seasoning and dressing it receives in currying make it soft and smooth.

Delicate skins for gloves and slippers, mostly kid skins or sheep and goat splits, are "tawed" in salt and alum solution or light chrome solution and then dried and finished. The preliminary process is merely pickling in brine.

OIL TANNING

is used for deer, buck, chamois and sheep skin splits. The ordinary commercial chamois is only the inner layer or flesh side of a split sheep skin. Splitting is done on a splitting machine, as shown in the next illustration. Cod oil or a combination of oils are used. Skins are placed in "kickers," so-called. These are wooden boxes holding several dozen skins, which are rolled up and sprinkled with the oil. The long arms or "kickers" hanging from above work in opposite directions in the boxes and pound the oil into the fibre. The skins are removed when temperature in these boxes rises to about 100 to 150 degrees and piled up to dry. In piles the heat rises still more and the temperature reaches about 180 degrees. Heat oxidizes the oil and the skins turn yellow. After partial drying they are again worked once or twice and then put under a press, which removes the excess grease and moisture. The thick greasy matter expressed is sod oil, used as a currying agent. Sod oil in combination with other grease forms "degras," another valuable currying agent.

Open air drying is customary with chamois, as the sun is required to bleach the skins.

It is difficult to explain the exact nature of tanning, in fact, it is not well understood anywhere, but various explanations are given. Hides are composed of bundles and bundles of minute fibres interwoven and forming a microscopic network structure which must be cleaned of lymph and blood by the preliminary processes. The tanstuff soaks into this fibre structure and prevents the individual fibres from adhering to each other when dry, thus the leather is soft and smooth. Chemists say that there is a chemical combination between the tanning agent and the hide substance. This would follow when vegetable tannins or chrome was used, but alum or salt can be washed away in a hot water bath, and consequently there does not seem to be a

combination or union of the two. Oil, of course, merely decomposes in the hide structure and becomes fixed by oxidation.

CURRYING AND FINISHING PROCESSES.

The methods of procedure among curriers are greatly diversified and there is no regular rotation of processes. Each currier finishing a particular grade of leather has his own methods.

SPLITTING.

Steer- and horse hides are often very thick and heavy and must be split to be properly handled. Splits are often retanned. The splitting is done on a machine called a belt or band knife splitting machine. The knife runs the length of the machine and over two large wheels. It has a razor edge. The machine shown is made in various sizes, from 36 to 106 inches wide, and



BELT KNIFE SPLITTING MACHINE.

is used for splitting both limed and tanned skins and hides, especially by manufacturers of automobile, carriage and shoe leathers made from hides. It is also used by manufacturers of bookbinders', pocketbook and bag leathers, which are split in many cases after being completely finished.

SKIVING, SHAVING AND WHITENING.

These processes are all similar and we will consider them in order. Skiving is removing thin shavings from the flesh side of the skin. This is a machine process, as are also the others. Shaving is taking off a very thin slice on the flesh side. The cutting knife is corrugated and continuously sharpened by an emery wheel. The machine shown is used by manufacturers of upper leather of all classes; also by harness leather and belting leather tanners. Whitening is the same process, taking a smaller shaving from both flesh and grain side. The grain side being, of course, the hair side and the flesh side that next to the animal.

STUFFING AND OILING.

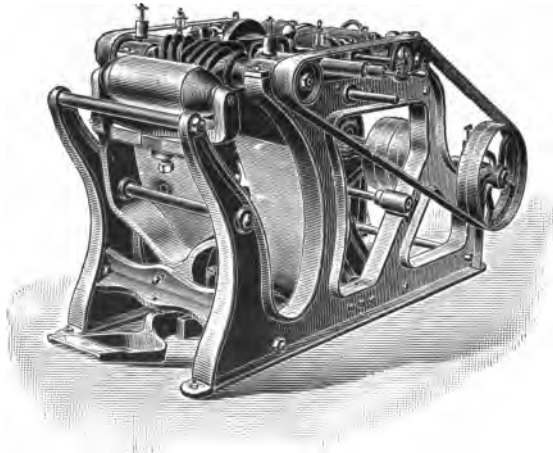
Heavy skins are hard and refractory when tanned and are rolled in "stuffing chests" or wooden drums with grease which is absorbed by the fibre, making the leather soft and flexible. Lightweight skins may also be treated this way.

PUTTING OUT OR SETTING OUT.

This is a machine process. Skins are fed under a steel roller, ribbed, as shown in first illustration. The ribs are in two sections set diagonally and revolving away from each other. This stretches and smooths the skin and presses out excess water and grease. The machine shown is used by goatskin and sheepskin manufacturers for putting out and also for unhairing. In the latter process a knife is inserted under the roller which neatly shaves off the hair.

STONING, STAKING AND SOFTENING.

The machines used for these processes are similar. Occa-



SHAVING MACHINE.

sionally the work is done by hand. Stoning is laying the fibre on the under or flesh side of the skin. The machine is of the "jack" type. The one in the cut is used for glazing or giving a glacé finish, but machines of this general type are used for rolling, graining, staking and softening. In stoning, the long under arm of the "jack" is fitted with a smooth stone, the upper with a smooth hard rubber or steel roller. The action of the arms draws the stone back across the skin, laying the rough

fibre. In staking and softening the arms are fitted with a roller above and two steel knife-like projections below, which pull the skin, stretching and softening it.

BUFFING.

A sharp knife, called a "pusher" or "slicker," is pushed over the grain side, taking off a very thin shaving. This is some-



LEVEL BED GLAZING MACHINE.

times done on a buffing wheel covered with emery or sandpaper. It makes the grain soft and keeps it from cracking.

COLORING.

This may be done on both sides of the skin by immersing in a coloring solution composed of aniline dyes. When one side only is colored it is brushed by hand. Aniline dyes are used.

A great many skins are colored black, and for this a solution of logwood is used. It can be mixed by the currier or secured already prepared from chemists supplying the trade. Colors vary, of course, with the business, each currier having his own secret mixture of dyes to produce a desired shade.

SEASONING AND DRESSING.

Manufacturers are loath to part with any information of this process. Various oils, degreas, heretofore mentioned, and albumens form the principal ingredients. They are worked into the leather and give a fine finish.

GLAZING, GLOSSING AND PEBBLING.

These are final processes and depend on the use for which the finished leather is intended. Various machines are used, but are of the same "jack" type as the level bed glazing machine,



A POWER HYDRAULIC PRESS.

which gives a bright finish on sheep and goat skins when desired without the use of japan. For the other processes the arms are fitted with steel rollers, or for glazing, gloss or agate rollers, cut in different designs, which run over the grain, giving it a fine corrugated or pebbled or fancy finish. An embossing machine for much the same purpose is shown. This machine is a power

hydraulic press, which is being generally adopted by tanners of leather who require smooth finishes on high grained skins, or who wish to emboss imitation grains on various kinds of leather. A new German machine called a "winch" is now on the market. It handles heavy hides to be embossed.

This completes a very interesting succession of processes, but in going through the tannery and curry shop we have not noted the hazards, which are always the important features for the underwriter to consider.

HAZARDS OF TANNERY AND CURRY SHOP.

The introduction of bark extracts and chrome salts some years ago has practically done away with the most serious hazard of the tannery. Bark mill fires and boiler house fires resulting from the use of spent tanbark for fuel were of common occurrence. Bark grinding produces a fine dust which covers walls and floors, presenting an explosion hazard, as found in flouring mills. The dust also feeds any fire caused by sparks from foreign substances in grinders. Steam jet or blower system would dispose of the danger and should be installed where bark mills are operating. Eliminating the bark mill hazard, which is found in only a few of the older sole and harness leather tanneries, we note but very few special hazards of importance.

LIME.

The use of lime is always more or less dangerous. It is slaked in a yard or perhaps on beam house floor. Barrels of lime are rarely ever found in more than seven to ten barrel lots. They should be stored outside and properly protected from moisture. Sodium sulphide is sometimes used in place of lime and is not hazardous.

On passing through the beam house one wonders how a fire could gain any headway. Very often one passes from one part to another over planks laid across the tops of the vats or pits which are sunk in the ground. All the wood is water soaked, more or less, and one finds numerous hose lines and pipes spouting water. This is true of even a moderate sized beam house.

FLESHINGS AND HAIR.

These should be removed from the beam house daily, and as good cleanliness as possible maintained. Hair drying is very often done in patent dryers. Inspectors or examiners should make careful note of method employed. Sprinkler or steam jet should be installed in dryer. In a great many cases hair is removed wet, with fleshings, and piled in the yard.

SKIN DRYING.

Hides and skins are taken to upper floors and placed over poles or tacked on board squares, which are hung on horizontal poles running the length of the loft. Three methods are in use

for drying—hot air blower system, or cold air blower system, or steam pipes at sides and centre of loft.

Woodwork should be carefully protected from steam pipes. Lofts should be kept clean and blower fans properly oiled.

OILS AND GREASE.

This is a considerable hazard in the curry shop, where stuffing and putting-out processes are carried on. Floors are bound to be grease soaked. This is confined to heavy leather workers, however, as light skins do not require stuffing.

BUFFING AND SHAVING.

Considerable dust and refuse result from these processes. In the better risks blower systems are generally installed to care for the refuse from the machines. This assists materially in maintaining good housekeeping. Leather shavings contain enough grease to present, where allowed to accumulate, the same hazard as oily rags.

There is no hazard in the use of coloring matter or aniline dyes. These are usually stored in a small house detached and handled by superintendents or confidential employees, and mixed as required. Extracting is not done by tanners. Sheep and pig skins contain considerable natural oil and are sent to a degreasing plant before being tanned, where they are put through a naphtha process to remove the natural oil, which otherwise would ooze out after tanning and spoil the leather. They should be thoroughly aired, however, before being worked.

Tanneries, both brick and frame, have proved fairly profitable to most companies, and very profitable to some. The fire record has been good as a class and excellent on sprinklered risks of the class.

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WOOLEN MILLS.

The Manufacturing Processes, Fire Hazards, and Fire Protection of Woolen Mills, Mixed Woolen Mills, and Mixed Mills.

By F. W. Eames, With the Factory Insurance Association, Hartford, Conn.

Woolen manufacturers are divided into two principal and distinct divisions known as woolen and worsted, the manufacturing processes being in many instances widely different in character. It is the intention in this article to give a general outline of the manufacturing processes, fire hazards, and fire protection of a class of mills known variously as woolen mills—mixed woolen mills or mixed mills, such as the inspector commonly meets in the East, especially in the New England field, and to give no extended consideration to worsted mills.

ANCIENT PROCESSES.

The manufacture of wool into fabrics dates far back into antiquity. At the time of the Macedonian conquest, about 336 B. C., the natives of India wore shawls of great beauty. It is evident from historical references that fine woolen goods were used long before the time of Alexander (356 B. C.—323 B. C.). The Greeks learned many processes of woolen manufacture from the Egyptians, the Romans from the Greeks, and from the Romans the knowledge has generally pervaded the occidental world. Among the ancients, the method of manufacture was to thoroughly cleanse the wool, then sort, card, and spin it by hand. The loom for the weaving was remarkably simple, even if crude, but under their skilled operation they produced fabrics that have never been excelled in fineness of texture and delicacy of construction even at this late day with our modern machinery. Even in the early history of our country we read of the "home spun" clothing worn by the people of that day and some of us have seen the old hand cards, the old spinning wheels and the looms that were used in making the yarn and weaving the cloth.

There was a time, so we are informed, when woolen cloth was woven from fresh new wool. Later, wool shoddy in small quantities was mixed with new wool. In these days, however, we find the majority of woolen mills mixing a small quantity of new wool with other cheaper fibres, for a vast amount of our woolen goods are not made entirely of new wool, or even

wool, by any means. Now, it must not be understood from this statement that there are no woolen mills which use new wool entirely, as a raw stock. There are a few that do; there are more that use new wool mixed with wool shoddy, and still more that use wool, wool shoddy and cotton. Whatever the class or grade of woolen goods manufactured, however, the processes are for our purpose practically the same and the comparative fire hazard of the properties depends principally upon the amount of the lower grade and inflammable fibres used.

Woolen mills, as a class, offer a large number of fire insurance problems on account of the variety and character of their raw materials. The insurance inspector is confronted with the proposition of locating and protecting the machinery necessary for the preparation and working of these stocks, some of which are not, from his point of view, perfectly adapted for the use to which they are put—and in addition to this he has to consider the important question of their storage, in many instances far from ideal. In the first place, let us consider the

RAW STOCK

commonly found in woolen mills. This consists of wool, shoddy and cotton, and in many instances, in addition to these, rags, silk noils, wool noils and perhaps also cotton and worsted yarn—although, strictly speaking, yarn is not a raw stock, it being the manufactured product of some other mill.

Wool, as the term is commonly applied to the textile trade, is the fleece of sheep. It is graded according to its length and fineness of fibre and is usually received at the mill "scoured," that is, washed free of all dirt and animal oils. It is not uncommonly received in the fleece, and in this form it is known as "wool-in-the-grease," or "grease wool." Wool is received at the mill in both bags and bales.

Wool noils are the by-product of the worsted mills and are the short fibres combed out of the long wool or tops. They are all new wool, but being of a shorter fibre are considerably cheaper. Wool noils are graded according to the length of the fibre.

Shoddy is a term applied to picked rags—that is, rags torn to shreds or to fibre—and may be all wool or partly other fibres, such as cotton. It is the product of the shoddy mill or shoddy department of the mill, and owing to the fact that it has been worked back into fibre from cloth and that portions of it have probably passed through this same process a number of times before in being manufactured, it is necessarily of a comparatively short fibre. Shoddy also is graded according to its length of fibre. Shoddy is received in bags and bales, white, colored and mixed colors, the bags weighing about 150 pounds and the bales about 600 pounds.

Cotton is a vegetable fibre coming from the seed boll of the

cotton plant. It comes to the woolen mill baled in various forms, such as carded, white and colored cop waste, ordinary ginned cotton and ordinary cotton colored. The bales usually weigh about 500 pounds.

Silk noils are the short fibre or waste of the silk mills and are usually received in bales. These noils are simply used as a cheap fibre, they being cheaper than wool, to mix with the other stocks. They have no unusual inflammable quality and require no special machinery or preparation.

PROCESSES IN WOOLEN MANUFACTURE.

In taking up the processes connected with woolen mills we will assume a mill to have every department from the preparation of each and every raw stock to the finished cloth. Such a mill is not uncommon, although they are by no means in the majority.

The processes in such a mill consist of wool storing, scouring and drying, rag sorting, carbonizing and drying, stock dyeing, stock mixing, carding, spinning, skein dyeing, preparation of the warp yarn, weaving, wet finishing, piece (cloth) dyeing and dry finishing. It is these processes that will now be taken up more in detail.

WOOL SCOURING.

Fleece wool, wool-in-the-grease or grease wool, as it is known, is received by the mill in bags or bales, the bags usually weighing from 200 pounds to 300 pounds and the bales from 400 pounds to 900 pounds. Its preparation consists of sorting, washing, or "scouring," as it is called, and drying.

The wool is opened up in the sorting room and spread out on benches, where operatives cut from the fleece the different grades. In woolen mills only a few grades are separated in this manner. After being sorted it is either bagged up or put into bins and then goes to the scouring machines. The scouring process is done in a long tank or trough-like machine divided into three and sometimes four compartments, known as bowls. In the four bowl machine the first bowl contains a strong solution of soap and water heated by means of steam to a temperature of 120 degrees. The next two bowls have a weaker solution of soap and water at 115 degrees of temperature, and the fourth bowl contains water at about 110 degrees. Three bowl machines are the same as the four bowl machines except that one of the bowls containing the weak solution of soap and water is omitted. The soap used is composed of olive oil, red oil, caustic soda and alkali.

The wool is fed in at one end of the first bowl by means of a machine known as an "automatic feed," which is for the purpose of feeding it in evenly. In its progress through the bowls the wool is agitated in the washing solution by means of rakes operated mechanically, and is carried from one bowl to the next by

endless slatted belt aprons. At the discharge end the wool passes up an incline and between wringer rolls which remove most of the water, and is then carried by hand or by mechanical means to a dryer, where it is thoroughly dried. Wool shrinks one-third to two-thirds in weight by scouring. There are several types of

MECHANICAL DRYERS.

all of which at one time or another will be met with in the inspection work. The simplest form is the open table dryer, which is a wire netting set about three feet from the floor, supported by a wooden frame, and wood sheathed from the netting to the floor. At one end of this is a fan and system of steam coils, all enclosed. The stock is spread out over the netting and dried by air current, circulated by means of the fan, through the steam coils and stock. This form of dryer requires considerable labor in handling the stock, and for this reason a continuous process is usually employed. Generally speaking, a continuous dryer is a box-like machine containing an endless woven wire apron or perforated sheet iron table for carrying the stock, and having in the same enclosure a system of steam coils and fans for heating and circulating the air current. Some of these machines are simply enclosed with one inch wooden sheathing; others are sheathed and tin-lined. Some are sheet iron, some steel frame work and covered on the outside with asbestos, and still others are of sheet iron covered on the outside with sheathing and having an air space between the wood and metal work. The stock is distributed evenly on the apron or table by means of an automatic feed, and the speed of the machine regulated according to the nature of the work. The circulation of the air from over the steam coils and through the stock removes all moisture, the moist air being exhausted from the machine by means of a fan arranged for this purpose. These dryers are usually operated at from 170 degrees to 230 degrees temperature.

SORTING.

In order to facilitate the sorting it is the practice in the wool sorting room to warm the wool over steam pipes in cold weather if the wool is received from unheated storehouses and is cold and stiff. These steam pipes usually run close to the floor and have an iron grating over them, making a long, slightly raised platform on which the bags of wool are set on end to be warmed before sorting. Sometimes there are long boxes built enclosing the coils which are large enough to admit the bags, or the wool is put in loose.

The warming of the wool in this manner offers a slight fire hazard, not from any liability of fire in the wool, but from the greasy burlap bagging in case of contact with the hot steam pipes in improperly installed or neglected systems. The system should be installed so that the bagging cannot come in contact

with the pipes, and there should be good clearance between the pipes and the enclosure, whether it be of wood or metal. When the box arrangement is used the enclosure should be tin-lined. There is no fire risk in the wool sorting and the scouring process is wet and non-hazardous. The dryers are operated at a comparatively low temperature, and as the stock is practically non-inflammable there is little or no liability of fire in them.

BUR PICKING.

In addition to the grease and dirt, all wool contains more or less foreign matter in the form of burs gathered by the sheep on their feeding grounds. The scouring process does not remove these burs from the wool, and in order to free them from the stock it is necessary that it be either passed through a bur picker or carbonized. The bur picker is a machine similar in design to the rag picker, which will later be described, except that the teeth on the cylinder are set closer together and there is an additional attachment known as the bur roll or extractor which picks up the burs as the stock passes through. A fan is provided at the top of the machine which carries off the light dust, while the burs fall to the floor of the machine. The burs in the wool may also be removed by carbonizing. This process is fully described below.

SHODDY DEPARTMENT.

The raw stock here is rags, usually received in bales weighing about 600 pounds. The first process is that of sorting, and this is done over tables having wire netting tops of large mesh in order that foreign material in the form of dirt, buttons, etc., may fall through as the rags are being handled. All cotton pieces and pieces containing silk are sorted out, and in some instances the rags are graded according to color. After the rags have been sorted they are ready for

CARBONIZING.

The object of the carbonizing process is to convert into carbon and remove all vegetable matter, such as the cotton fibre, leaving an all wool rag. There are two methods—wet and dry carbonizing. The wet process is, however, the one invariably used in woolen mills having shoddy departments. In the wet process carbonizing the rags are first placed in wooden vats or tubs containing a weak solution of sulphuric acid or chloride of aluminum and water, and there left to soak for about three-quarters of an hour. They are then removed from the vats, extracted to remove excess moisture and dried by means of a mechanical dryer, baked in another dryer having a high temperature, dusted, passed again through the baker dryer and again dusted. The baking increases the action of the acid upon the cotton fibre, with the result that it is reduced to a powder which the dusting process later removes, leaving only the wool. In order to neutralize the

effect of the acid, the rags are next washed in a solution of alkali, then extracted and dried.

THE EXTRACTOR,

or more correctly known as the "hydroextractor," is a machine for removing moisture from stock. It answers the purpose of a wringer machine and is simply a perforated copper can about four feet in diameter for holding the stock and which is made to revolve very rapidly in an upright position inside of a metal shell about five feet in diameter. The liquid is thrown off from the stock through the perforations, by centrifugal force, and is caught by the outside shell and runs away through an opening in the bottom.

THE DRYER AND THE BAKER,

which is really a dryer, are constructed and operated in the same manner as the machine dryers described under wool scouring, except that the baker is operated at a much higher degree of temperature (200 degrees to 280 degrees). The open table form of dryer is never used as a baker as it is not possible by this means to obtain the high temperature necessary, although there are in use many so-called bakers which are brick or wood tin-lined rooms fitted with steam coils, where the stock is spread out on netted tables. In small shoddy plants one machine is used for both drying and baking, the stock being usually run through more than once.

DUSTING.

The dusting of the stock is done by means of a machine known as a willow or duster. There are several types of these machines, but the type most commonly used is known as a cone, or brandy duster. This machine is shaped somewhat after the form of a truncated cone laid horizontally, the centre being set about three feet from the floor and then boxed from the horizontal diameter to the floor. Inside the truncated cone top is another truncated cone constructed of perforated sheet steel in which are set large steel teeth two inches to three inches long and three inches to four inches apart. There are usually four sets of these teeth extending the full length, and as it revolves they pass between similar teeth attached to the inside of the box. There is a fan connected at the end which carries off the light dust which is sucked through the perforations as the stock is stirred up between the revolving truncated cone and its outside shell covering, while the heavy dust and foreign particles fall through a wire screen bent to conform with the lower side of the revolving cone. The stock is fed in at the small end by means of a slatted apron feeder and is discharged at the large end through an opening in the side.

There is a modification of this machine, which has a frame

instead of the perforated steel truncated cone. In this form of duster the suction fan for removing the light dust is connected with a box set on the top of the machine. Dusters are sometimes used for mixing stock as well as for dusting. In large plants there is sometimes installed continuous machinery in the form of endless aprons which carry the stock from the dryer to the baker and from the baker to the duster.

THE DRY PROCESS CARBONIZING APPARATUS

consist of an iron box-like device about 15 feet in dimensions, inside of which is an iron cage arranged to revolve. Below and at the side of this is a brick fire box having an iron pot about two and one-half feet in diameter built into it. Through a small opening in the top hydrochloric acid is allowed to drip. As the acid comes in contact with the hot iron pot it vaporizes and the fumes pass into the cage inside of the box. The rags are placed in the cage and in it revolved a short time to thoroughly dry them, after which the acid is allowed to drip into the iron pot and the fumes to act upon them. The chlorine, hastened by the heat, which is about 200 degrees of temperature, acts upon the vegetable fibre in the rags, and they are thus treated with acid and baked at the same time. Treatment in this manner continues from three to four hours, after which they are taken out and dusted, neutralized in an alkali bath and dried.

PICKING.

After the carbonizing the next process is that of picking the rags. The machines used for this purpose are heavily built of iron and steel with wood covers, and are used to tear the rags into shreds, or "fiberize" them, as it is called. The machine contains a cylinder in which are set a large number of steel teeth. These steel teeth on the revolving cylinder tear apart the rags as they pass through between a set of feed rolls, and this fiberized stock is then blown from the picker to small blow rooms and from these bagged up ready to be sent to the mixing picker room and mixed with other materials. In some mills a lumper picker is used in connection with the working of shoddy stock. The machine has feed rolls and cylinder similar to those in the rag picker, but there is no cover on the machine. Lumper pickers when found in woolen mills are usually used to throw the lumps out of shoddy stock, the machine being so constructed that all light stock easily passes through, while the heavy lumps are thrown out to be worked over again. Owing to the fact that modern rag pickers have an attachment for doing this work the lumper picker is not commonly used.

FIRE HAZARDS IN SHODDY DEPARTMENTS.

Fires are of frequent occurrence in the shoddy department, and for this reason the building or rooms containing these processes

should always be well detached or cut off from the rest of the plant. There is little danger from fire in the rag sorting department. It is important, however, that the space under and around the sorting tables be kept clean. The early stage of wet carbonizing is a wet process and is non-hazardous, but the dryers and bakers offer a very serious hazard and should be operated in a separate room with good fire divisions between it and the rest of the property.

The high temperatures at which the dryers and bakers are operated, especially the bakers, cause many fires in the stock containing much carbonized cotton. The carbonized cotton in the form of dust sifts through the apron or table onto the floor below, making the condition of the machines very dirty and requiring great care in keeping them properly cleaned out. In addition to this, there is the hot bearing hazard of those bearings which are inside of the machine, as the excessive heat fairly boils the oil out of them so that they require constant attention to prevent overheating.

EFFECTS OF ACID FUMES ON SPRINKLERS.

The acid fumes in the dryers and bakers rapidly corrode and load the sprinklers in these machines, making them less sensitive or even inoperative, and making necessary the changing of these heads at regular intervals. The use of "corroproof" sprinklers in dryers and bakers has proven of practically no benefit in overcoming this trouble, as the corroproofing melts away, leaving the head in no better condition to withstand the action of the acid than the ordinary sprinkler. There is practically no fire hazard in the operation of the ordinary open table dryer. The hazard of dry carbonizing lies principally in the fact that there is a fire within the building, but with the proper construction and arrangement of the fire box and a non-combustible floor in the vicinity the hazard is probably no greater than that of the baker in the wet process.

The fire hazard of the dusting machines is mainly from friction, due to the dust gathering on the bearings, but this hazard is not serious. The dust taken up by the blower fans on the machines should always be arranged to discharge to the outside of the buildings.

Rag pickers are a constant source of fires, and probably more fires occur in them than elsewhere. The danger is so well known that the operator of the machine is constantly on the alert and extinguishes them with pails of water directly at hand so that the inspector hears of only a very small percentage. The principal cause of fires in rag pickers is probably from heat, due to friction caused by the working of the stock on the cylinder against the stock on the feed rolls, although many fires are also due to foreign material in the stock. Rag pickers should always be located in a separate room, well cut off from the rest of the property, and they should

be arranged to discharge into fireproof sprinklered blow rooms, preferably near the machines.

PREPARATION OF COTTON.

It is rarely that the woolen mill contains preparatory machinery for the working of cotton before it is mixed with other fibres. In some cases there are grades that are put through a bur picker or a mixing picker before being used, and the writer has in mind one mill operating a straight cotton department up to, and including, the cards, but this is a very rare condition. The cotton is usually mixed with the wool and shoddy stock in the form purchased, except that it may be colored at the mill.

DYEING.

In order to obtain the variety of effects necessary in the different fabrics, the different fibres are often colored before being mixed together. There is an endless combination of colored and uncolored stock of the different fibres mixed to obtain these effects, but as they have no special interest to us as students of fire protection, only a brief and general description of dyeing is necessary.

The stock is placed in large wooden tubs set in the floor of the dye house and there boiled. The boiling is done by means of live steam turned into the dye liquor near the bottom of the tubs. After the stock has been subjected to this treatment for the required length of time, the fluid is drawn off, the stock pitched out of the tubs with forks and then taken to a hydro-extractor. After being extracted the remaining moisture is removed by means of dryers, one of the types previously described being used for this purpose.

There is no fire hazard in connection with dyeing and no special protection is necessary. This fact is not true, however, of the drying process. Drying machines in this department, as well as in those previously mentioned, are a constant source of trouble on account of small fires, especially where cotton or any mix of cotton is being dried. Some of these may be due to defect in the machine, some also may be due to the nature of the cotton dye, especially in sulphur black colors, but probably the majority can be directly attributed to carelessness or ignorance on the part of the overseer or workmen who insist upon operating the machines under high temperatures when drying cotton the same as when drying all wool stock.

The drying of sulphur dyed cotton stock involves a serious fire hazard that should not be overlooked. Comparative tests made with washed and unwashed sulphur dyed stock show conclusively that unwashed or improperly washed stock is extremely liable to spontaneous ignition, accelerated by the heat

in drying, while in stock carefully washed after dyeing there is little hazard.

This is one of the principles that the inspector must preach during his inspection work, also to bring every effort to bear in reducing the temperature in dryers when cotton is used.

PICKING.

Pickers as a class are machines in which is set a cylinder provided with steel teeth, which open up the stock as it is fed in from a moving apron through the feed rolls. The number, arrangement and character of the teeth vary with different types of pickers and with the class of stock used; the finer stocks being worked on machines with the greater number of teeth. As the stock passes from the picker it is usually discharged into an enclosure in, or adjacent to, the picker room, although it is sometimes taken by means of a blower system to some other portion of the mill.

There are four principal kinds of pickers more or less common to woolen mill picker rooms—rag pickers, lumpers, bur pickers and mixing pickers. Three of these—rag pickers, lumpers and bur pickers have already been mentioned.

Even though a mill does not carbonize its rags or operate a full process shoddy department, there may be one or more rag pickers located in the picker room for the purpose of picking their own cloth clippings, yarn waste, or rags purchased from outside parties, and if so, a lumper picker might be used and located in the same room.

The bur picker, as previously stated, is used to throw out burs and foreign substances as well as to pick the stock. As a rule, wool is the only fibre worked on this machine, although it is not uncommon to find it being used to open up cotton and other stocks, especially soft mill waste. There is no serious hazard in connection with this machine when only wool is used, but the hazard increases with the use of more inflammable fibres. The various stocks, having now been prepared, are brought to the mixing picker for the next process.

The mixing picker is used to mix together the various kinds of stock, and its fire hazard depends principally upon the amount of cotton present. In the process of mixing, the various grades and classes of stock are weighed out and laid down on the floor of the picker room one layer on another, making a pile from three feet to five feet high. As each layer, except that of the cotton, is laid down, it is sprinkled with an emulsion, or mixture, composed of borax water and olive or red oil. This emulsion is applied by means of a large specially constructed can somewhat similar to the ordinary hand watering pot, and is for the purpose of making the fibre more pliable and more easily worked in the succeeding processes. Some mills have an attachment

on the mixing picker which applies this emulsion to the stock as it passes through the machine.

After the stock has been laid down and oiled in this manner, the pile is broken down vertically and put into the feed of the mixing picker by hand. It is discharged through a box trunk-like arrangement into the room occupied by the picker, or into a blow room partitioned off near the machine. In order to make a thorough mix, the stock is put through a mixing picker at least twice.

CARDING.

The next process is the carding, and this is also the last preparatory machine for the stock before it is spun into yarn. The purpose of the carding is to straighten out the fibre of the stock. The stock is fed by means of a Bramwell feed, or some similar automatic regulating device, onto a system of cylinders covered with clothing in which fine wire teeth are set very closely together. The cylinders are arranged with several small cylinders about 7 inches in diameter, called "workers," placed about 12 inches apart around the upper half of one, and sometimes two, large main cylinders, about 48 inches in diameter. The purpose of the small cylinders is to take the unstraightened fibre from the large cylinder and to put it back onto the large cylinder again by means of small stripper rolls set between the workers and the main cylinder. The stock receives its straightening by being drawn over the workers and strippers, this being repeated on each set of workers and strippers, and when removed from the last stripper onto the main cylinder, is well straightened.

The stock is deposited from the main cylinder onto a doffer roll, similar to the workers, except of larger diameter, and from this removed by a doffer comb, which is a small flat rod with pointed teeth, extending the width of the doffer roll, and which moves rapidly up and down, combing the stock from the doffer roll.

The stock then passes onto a second card or second breaker in the form of roving, and sometimes known as "drawing," where it is laid down back and forth diagonally on a horizontal traveling feed, and passes through the same carding process again.

After passing the second card, it again goes in the form of roving, to the third card or finisher, which differs from the first and second cards at the delivery end only, and from this machine it passes in the form of strands resembling untwisted yarn known as "roping," and is wound up on large spools.

There is a type of wool card called a "garnett machine" which is often found in woolen mills. The machine is for the purpose of working back into the original fibre all descriptions of waste, cuttings, etc. This machine consists of from one to

three main cylinders, above which are arranged smaller rolls or workers. All are equipped with steel teeth similar to saw teeth and resemble a number of circular saws set close together on a cylinder. Both the main cylinders and workers operate at high speed and in consequence create considerable fly. The stock is discharged from the machine onto the floor. There is only a

SLIGHT DANGER OF FIRE IN CARDS

in a high grade woolen mill. The danger increases with the percentage of the lower grades of stock and cotton used. The main cause of fire is from foreign substances in the stock such as matches and pieces of metal. These strike fire on the so-called "licker-in" roll which is near the feed on the first card. There is also some liability of hot bearings on the fast revolving small cylinders setting fire to the fly on the machine. Card room fires are hard to handle, especially if there is any amount of cotton in the stock, as the fire is extremely liable to flash over the entire machine and often through the entire set of cards. The clothing, cylinder lagging, rub aprons, etc., are very susceptible to water damage, and the loss is likely to be large and difficult to adjust with any degree of accuracy.

We must remember that woolen cards are not adapted to the working of cotton. They are constructed along entirely different lines from cotton cards and operate at much higher speed. For this reason there is always a large amount of fly where cotton in any great quantity forms a part of the mix, which collects on the frame of the machine, electric light cords, floor, etc., and this is a dangerous factor in the event of fire.

Great care should be exercised in keeping the card room clean, and also in keeping the card waste, which accumulates under the cards, swept up and removed to detached waste houses.

The danger of fire in garnett machines can be put down principally to foreign substances in the stock and to hot bearings. Owing to the character of the stock worked on the machine, it should always be located in the picker room or some similar place where it is well cut off from other portions. The machine itself is all metal and not very susceptible to fire or water damage, the principal susceptibility to damage being on account of rust, if wet and not properly cared for later.

SPINNING.

Spinning is the process of reducing the roping as it is received from the finisher card, to the required weight in the finished yarn, and at the same time giving to it such twist as is required for strength. This spinning is done by means of "mules" or "jacks." This is not a continuous process as in the case of ring spinning found in cotton and worsted mills

and described to you by Mr. Wilbor in his paper on "Cotton Mills"—the spinning and winding up of the yarn being two distinct operations of the machine.

A mule consists of two parts—the fixed frame which supports the spools of roping and drawing rolls, and the carriage containing the spindles. The carriage is mounted on wheels that run on tracks and travels back and forth a distance of about five feet from the drawing rolls. The spindles are of steel and stand vertically, the lower end resting in a metal step or bearing, and each spindle is driven by means of a small cord belt, from a drum extending lengthwise through the carriage. Wooden bobbins, on which the yarn is wound, are set on the upper end of the steel spindles and project above the top of the carriage.

The drawing and twisting of the yarn is done with the outward movement of the carriage, the spindles revolving rapidly in the meantime. At the end of the "stretch," the rolls, carriage and spindles stop; the spindles then start more slowly and wind up the twisted yarn as the carriage is drawn back to the fixed frame.

When the bobbins have been filled, the mule is stopped, they are removed from the spindles, thrown into baskets, and taken to the next process. Warp yarn is the yarn which runs lengthwise of the woven cloth, and filling yarn that which runs at right angles, or across. The process of manufacturing both is the same, the difference being that warp yarn has more twist.

FIRE HAZARDS IN SPINNING.

The principal cause of fire in mule spinning is from friction in the steps of the spindles and at the main journal or head. The spindles revolve at a very high speed and it is necessary to use quantities of oil in the steps, which in time spatters through the interior of the carriage. This oil, with the collection of lint, etc., always present, forms an easily ignitable covering over the carriage. Fires in this department are not, however, of frequent occurrence, nor are they as a rule the cause of severe loss. The mule carriage offers an obstruction to the overhead sprinklers and prevents them from covering that portion of the floor under it, thus sometimes allowing a fire to work its way entirely across a room unless prompt action is taken in the use of fire pails or hand hose. For this reason extreme care should be exercised in keeping the floor thoroughly swept clean and the carriage free of lint.

Many woolen mills use considerable yarn which they do not manufacture. They may purchase and use various grades of cotton and worsted yarns. These yarns are purchased in skeins, or on bobbins, cops, and spools, and may be white or colored. Each may be used for either warp or filling yarn. Cotton

and worsted yarns may be twisted together with each other into one yarn, or either may be twisted with woolen yarn.

If the yarn is to be dyed before being woven, it must be in skeins, and if it is not already in this form it must be gotten so by being wound onto reels from the bobbins, cops or spools. Filling yarn is rarely skein dyed, but is usually colored in the stock.

Yarn dyeing, or skein dyeing, as it is called, is done in long rectangular tubs containing the dye liquor, the skeins of yarn being inserted on long poles whose ends rest on the top of the sides of the tub, allowing the yarn to hang in the liquid. From time to time during the process they are moved about by the workmen so as to insure uniform dyeing. The washing is done in a similar manner in similar tubs filled with water.

After the dyeing and washing, the yarn is dried in yarn dryers especially constructed for the purpose. Some of these dryers are constructed after the manner of the single apron stock dryers, except that there is no apron in the machine, but instead there is an endless traveling chain on each side of the machine constructed to receive the ends of the poles on which the yarn is hung.

There is another type known as the Bailey Dryer, which is after the form of the Ferris Wheel, the poles containing the yarn being set across from the circumference of one wheel to the other. After the machine has been filled in this manner it is revolved rapidly. This dryer is sometimes located in an open room and sometimes in a steam heated enclosure. Yarn dyeing and drying is non-hazardous.

The filling yarn is used in the shuttles of the looms and goes direct to the weave room, except that it is sometimes steamed in order to take out kinks and made more flexible, thus avoiding breakage in weaving. This steaming process is done in a small tight wooden or iron box to which is connected a steam pipe, the filling yarn in baskets being set into this box and live steam turned in.

The yarn for the warp, however, must go through several other processes, all of which are for the purpose of joining the short strands of yarn on the bobbins into long pieces and getting a large number of these onto the loom beam. These processes are known as "spooling," "dressing" and "beaming." In addition to this the yarn is sometimes starched to make it run more smoothly in the loom harness, and it is then drawn through the reeds and loom harness and sent to the weave room. There is no fire hazard in connection with the preparation of the warp yarn.

WEAVING.

Woven fabrics are made by interlacing yarns at right angles to each other by means of the loom. The warp is located

on a beam at the back and passes through a set of harnesses and a reed. The harnesses of woolen looms are usually operated by a device known as a dobby, located at the top, the levers of the dobby being operated by a pattern chain which extends down the side. The shuttle carrying the filling is driven back and forth between the warp yarns, and the reed coming forward after each passage of the shuttle beats up the filling into the cloth. The harnesses through which the warp passes change position after each passage of the shuttle, thus binding in the filling.

The kind of weaving which consists of passing the filling alternately over and under each thread of the warp is called "plain weaving," but if the weave takes up first one, then two threads, alternately of the warp and passes the filling under them for the first shoot of the shuttle and then raises those that were left down before the second shoot, it produces a cloth with a very different appearance, called "twill," many varieties of which may be produced by varying the number missed and taken up.

Looms are made in various widths and the speed of the machine is governed by the width and class of goods manufactured. The weaving process is non-hazardous, except for the hot bearing hazard, which is light.

FINISHING.

After weaving, the cloth is wet finished. The wet finishing process consists of fulling, washing, gigging, and, if the cloth is not to be dyed or carbonized, drying.

Fulling is a shrinking process and is done in high wood tub-like machines called "fulling mills."

The pieces of cloth, as they come from the looms are sewed together end to end, making a long piece. This piece, after being put into the fulling mill, has its ends sewed together, making it an endless piece. When the machine is in operation this endless piece of cloth is passing continuously from the bottom of the machine, which contains a solution of soap, up into the top through metal boxes which gather it together and pass it between wooden rolls weighted to produce pressure. This process shrinks the cloth, both as to width and length, producing a closer weave.

In some classes of woolen goods, in order to increase the weight, ground shoddy known as "flocks" is rolled into the cloth by means of the fulling mill. If the cloth is to be thus treated the "flocks" is put into the mill and rolled into the cloth dry, after which the cloth goes through the regular fulling process, the shrinking together of the yarns holding it in place.

After the fulling process the cloth is thoroughly washed to remove all traces of the oil put on the stock in the early stage

of the preparatory process and dirt accumulated in its manufacture.

After the fulling and washing the cloth is sometimes giggered to raise a nap. The machine used for this purpose and known as a "gig," is simply a cylindrical iron frame on the curved surface of which set a large number of teasels. This cylinder revolves in contact with the cloth, and gives to the surface a downy appearance.

Teasels are dried flower heads, having stiff hooked bracts. In some mills it is the practice to wash the cloth before fulling and the giggering may be omitted in the wet finishing and done in the dry finishing process.

If the cloth is to be dyed it is next taken to the dye house. Cloth dyeing or "piece dyeing," as it is called, is done in specially constructed rectangular tubs containing the dye fluid and having a wooden roll or reel arranged above them, sometimes in a hood, over which the cloth passes as it goes in and out of the dye fluid, the cloth being kept continuously in motion during the dyeing process. After being dyed the cloth is thoroughly washed, then extracted in a hydro-extractor, and taken to the cloth dryer.

If the wool, before being spun into yarn, has not been carbonized to remove small particles of burs, these particles may be taken out of the cloth by carbonizing. It also frequently happens that in making up a cheap all wool fabric from short fibre stock, it is necessary to mix with it about 5 per cent. of cotton to strengthen and hold it together in spinning and weaving the yarn. This cotton is also removed from the cloth by carbonizing.

The process of carbonizing cloth does not differ materially from stock or rag carbonizing, except that the baker is in the form of a cloth dryer instead of the type described.

Cloth dryers are usually a system of steam coils set in sections, one above the other, and all supported by a steel frame and enclosed by frame, tin, and asbestos lines. The arrangement is such that the cloth, after entering the machine, passes back and forth between the steam coils, finally coming out overhead at the same end of the machine as fed in and is, by means of an automatic device, folded up on a truck.

After being dried, the cloth is dry-finished by passing it through machines in contact with fast revolving brushes; sheared by revolving knives, or passed over rolls covered with sandpaper to remove roughness; steam brushed, and then pressed between steam heated rolls under pressure. In addition to this the cloth may also be napped by the giggering process already described, except that in the dry finishing, the nap may be raised either by cylinders covered with teasels, or by cylinders having metal teeth similar to those of card clothing.

After this, the cloth is inspected, and wound on small thin boards in pieces of about 50 yards in length. In this form it is wrapped up in paper, packed in cases, and shipped.

There is practically no fire hazard in the finishing processes except in the case of drying and carbonizing, and in this there would be little danger if the dryer enclosures were properly constructed, and protected, by being built of metal lath and plaster, sheet iron, or wood well lined with tin, and having asbestos board between the tin and wood work.

There is another class of woolen manufacturing plants known as "Worsted Mills" which have not been touched upon in this paper. The raw stock in a full process worsted mill is grease wool, and the processes, in brief, are—wool sorting, wool scouring, carding, combing, drawing, spinning, weaving, wet finishing and dry finishing.

The principal difference between the woolen and worsted processes is that the stock instead of coming from the cards in the form of roving, and going direct to the spinning department, comes from the cards in the shape of roving, and is wound up in the form of a ball, known as a "top." The tops go to preparatory grilling machines, which prepare them, still in the form of roving, for the combs. The combing machines comb out all of the short fibre and carry the long fibre into cans in a form resembling the silver as it comes from the cards in the cotton process. It then goes through a drawing process much resembling the drawing process in the cotton mill, which, is done by the slubbers and intermediates, and is then spun into yarn either by means of ring spinning frames, or by mule spinning frames.

It is not the intention of this article to take up in detail the installation of sprinkler systems and hydrant protection. Practically all modern woolen mills are so protected and this type of fire protection has been developed and perfected to such an extent that it is looked upon by the mill owner as a necessary factor in protecting his business as well as in reducing his fire insurance cost.

Automatic sprinklers, properly installed, cover every portion of the property. Not only should they be installed throughout every room and building, under every stairway, and in every closet, but in all blow rooms, stock rooms, throughout dryers of all descriptions, and in many instances it has been found advisable to install them over Bramwell feeds to cards, under the breasts of cards, and in and around any other machinery having a special fire hazard, as it is important that water be put upon a fire in its early stage when it can be controlled, and not allow it to gain headway, thus opening a large number of sprinklers and causing not only considerable fire damage, but enormous water damage as well.

The *Quarterly*, issued by the National Fire Protection Association dated July, 1909, contains a classified record of 750 fires in woolen mills, from which the following is a partial summary:

Common causes (lighting, heating, power, smoking, etc.).....	87 fires	11.6%
Special hazards.....	610 fires	81.3%
Unknown causes, incendiary and exposures	53 fires	7.1%

750 fires

Of the common causes, 23 fires, or 3.1% of the total, were from lighting, and 22 fires, or 2.9% were from power.

Of the special hazard fires, the following is of interest as showing the relative hazards of the various processes: Pickers, 290 fires or 48.9% of all; stock dryers, 132 fires or 17.6%; carding, 91 fires or 12.1%; spontaneous combustion, 35 fires or 4.7%; carbonized stock dryers, 11 fires or 1.5%; cloth finishing, 7 fires or .9%; spinning, 6 fires or .8%; dusters and willows, 5 fires or .7%; garnetts, 3 fires or .4%; weaving, 1 fire or .1%.

SHOE FACTORIES.

The Manufacturing Processes and Fire Hazards of this Important Industry Described.

By Dwight W. Sleeper, Inspector, Underwriters' Bureau of New England.

In order to bring so large a subject within the scope of a short article, it will be impossible to go into much detail, and it is therefore the intention to briefly describe the processes and hazards of the manufacture of shoes so that the reader may gain a general idea of this highly developed industry. It may be well to state now that there are many concerns who make a specialty of the manufacture of such things as cut soles, heels, box toes and counters, rands, trimmings, stains, blackings, waxes, gums, etc., and there are some shoe factories so large and complete that they manufacture all or part of these specialties in addition to retanning the sole leather, making paper and wooden boxes and shoe patterns. However, these factories are so few that only the ordinary ones will be considered in this article.

The following principal departments are found in all shoe factories: cutting, stitching, making, sole leather and finishing. Proceeding in the course which each order takes, we come first to the upper leathers and lining department. Thin, soft leathers, such as kid, colt and calf skins, are used for the upper part of shoes. These skins are spread on the blocks or cutting boards and the workman, carefully figuring the skins to avoid excessive waste, locates the metal-bound fibre patterns and deftly runs the blade of a sharp knife around the edge.

Within the last two or three years the "Ideal Clicking Machine," a light, power-driven stamping machine, has largely replaced the slower and less accurate hand method. With this machine the skins are spread on the block under the arm of the "clicker" and light, steel dies are placed in the desired position on the skin. The pressing of a little handle releases the clutch and the arm strikes the die, forcing it through the skin. Similar methods are used in cutting out the linings.

After the various parts of the "upper" are assembled they are carried to the stitching room. Several processes, such as skiving or beveling part of the edger, stamping ornamental perforations, numbering the pattern and size on the lining, and, on some kinds

of shoes, crimping, are conducted, and then the edges of the lining are coated with rubber cement, after which the linings are cemented to the leather. The parts are stitched together on power driven sewing machines and the "upper" is completed by the eyeletting machine which accurately eyelets the shoe with great rapidity. The uppers are then sent to the bottoming room to await the coming of the soles. Heavy power presses and steel dies are used for

CUTTING OUT THE SOLES

in the sole leather department, but many concerns now buy the rough-cut soles from outside concerns and these are placed on two wooden clamps, one of which is accurately shaped, and placed on a rounding machine, the blade of which runs rapidly around the sole, cutting it the exact shape of the pattern. The soles are passed through a rolling machine where great pressure is applied to compress the fibres of the leather, and through a splitting machine which splits them to the same even thickness. The inner soles for Goodyear welt shoes are then fed through a channeling machine which cuts a slit around the sole about one-half inch from the edge and the lip of the slit is turned in, making a shoulder against which the welt is sewn. A lining of cement-coated canvas is applied and then the soles are sent to the bottoming department to meet the uppers. There are

THREE METHODS OF MAKING SHOES

now in general use, viz., the Goodyear turn, McKay sewed and Goodyear welt methods. The first is used mostly in the manufacture of slippers and thin house shoes, and consists of placing the sole and upper on a "last" inside out and sewing the upper to the sole, after which the last is removed and the entire shoe turned right side out. The McKay sewed shoe has the upper drawn around the inner sole and then sewed through the inner sole and into a channel in the outer sole. The Goodyear welt method is a newer and better one, and is used entirely now on the better grade of shoes. This method will be described in greater detail.

In the bottoming department it is first necessary to lace the upper, and this is done by a very ingenious machine or by the insertion of a wire device which draws the upper together to a uniform distance. Wooden lasts or blocks of wood turned out in the shape to which the shoe is to conform are provided and the inner sole is partially tacked to the bottom of the last. The upper is then drawn down onto the last and the edges fastened at the heel and toe with a couple of tacks. The shoe is then placed in a "pulling over" machine, the jaws of which grasp the upper on the four sides, and the operator, by working the levers, draws the upper snugly and evenly into place and tacks are automatically driven through the upper at different points to hold it. The shoe is then removed and placed in a lasting ma-

chine, which with a human ingenuity draws all parts of the upper smoothly over the last, crimping the toe and heel and holding the upper firmly until the operator drives tacks all around the edges. The tacks at the heel are clinched against a metal plate on the last, but elsewhere they are only driven part way in and are later removed in the Goodyear process. After trimming off the superfluous edges of the upper a welt or band of leather is sewed around the edge in such a way that the stitch passes through the welt, the upper and the lip which was turned up on the inner sole, but does not pass through the inner sole itself. In this way the inside of the shoe is left smooth, differing materially in this respect from the McKay shoe. After removing the tacks, the superfluous edge of the welt is trimmed off and the welt hammered down smoothly by machines, and then the centre of the sole is "filled" with leather dust or ground cork mixed with rubber cement. A strip of leather-board and a shank are then inserted, after which the outer sole, previously coated with rubber cement, is applied. The shoes are then placed in a "sole laying" machine and great pressure applied to make the sole conform to a shaped mold and to make the outer sole stick on.

THE NEXT OPERATION

is the trimming of the sole and welt so they will protrude a uniform distance from the edge of the shoe, and this is also done by machinery. The heel part of the sole is then nailed on and the outer sole is channeled, after which the outer sole is stitched to the welt on a Goodyear outer sole rapid lockstitch machine. The lip of the channel is cemented and pressed back into place by a sole leveling machine. The heel is then applied, after which the edges of the sole and heel are evenly and smoothly trimmed by a rapidly revolving knife and the shoes are then ready for the finishing department.

In this department the edges of the sole and heel are first smoothly and evenly trimmed, then the sole is sandpapered smooth, after which waxes and stains are applied and polished to give the finished surface a high polish. The uppers are cleaned, polished, and the shoe lacings put in, and the shoe is ready for the market.

HAZARDS.

The principal hazard of the upper leather department, and one of the most prolific causes of shoe factory fires, is that of cutting boards scrapings. In order to keep the cutting boards as free from ridges as possible, it is customary to treat the surface with a dressing composed of linseed oil, carbolic acid, glycerine and other ingredients. However, after a time, the surface becomes ridged, and it is customary to scrape the boards once a week. These scrapings are very liable to spontaneous combustion, and

if placed in a comparatively close place, are almost certain to take fire. It is, therefore, absolutely essential that they be either removed at once to the boiler room and burned, or else placed in a covered metal can in which, if they should take fire, no damage can be done. The shoe factory fire record covering a period of about fifteen years shows that 4 per cent. of all fires in this class of risk have been caused by cutting board scrapings. The only other hazard of importance in the cutting department is that attending the use of naphtha black, and this will be mentioned under the general heading of naphtha.

The only important hazard to be found in the stitching department is the rubber cement hazard. This is used in considerable quantity, and is dangerous because of the inflammability of the substance itself, and of the naphtha fumes which it gives off. The cement should be used from so called "safety cans," of which there are a number on the market, all designed to hold a supply in an enclosed container, and allow a small amount to flow by gravity into a cup from which the operator fills the brush. This minimizes the amount exposed, and also prevents the evaporation of the naphtha, which is necessary to maintain the cement in a liquid form. Cement should also never be used near open lights. A paragraph will be devoted to the general handling of cement and naphtha.

The hazards of the sole cutting department are the cement and waterproofing processes. It is customary to coat the outer and middle soles with a layer of cement which is allowed to partially dry before sticking the two together. It is necessary to use a large quantity of cement in this work, and cementing machines designed to hold the cement in a metal reservoir and feed it onto rolls between which the soles are run should be used. The same precaution regarding the use of cement near open lights applies in this department.

When making shoes for winter wear, many manufacturers waterproof the soles by soaking them in a preparation of which there are several on the market. Viscol, resisto, repello and relyt are the principal compounds in the order of their hazardousness. Viscol is inflammable, and heat is necessary in using this compound, therefore it should never be allowed to be used in any important building. Resisto and repello are less hazardous, but are enough so to make it advisable to keep them out of the factory. Relyt is not hazardous, and may be used in the main building if desired.

With the exception of the use of rubber cement for laying the channels and in cork filling, the only hazards to be found in the making department are those of the stitching machines and edge setters.

It is necessary that the thread used in sewing the soles shall be waxed, and it is customary to run the thread through a pot

containing melted beeswax. The method of heating the wax as found in modern factories is to use a small steam coil, but in older factories gas, oil or alcohol lamps are used. The principal danger lies in the possibility of the wax boiling over and taking fire from the open lights, also the danger attending the filling and lighting of the lamps. It is apparent that steam is by far the more preferable method. The floor under the stitching machines should be covered with metal.

Edge setters are heated either by coal or gasoline gas. There is little danger from the former method, and not much more to the latter if a good make of carburetor is used for making the gas, and if the filling with gasoline is done outside the building. The capacity should be limited to one gallon.

The hose between the carburetor and machines should be of good quality, and the connections carefully made. All lights should be extinguished at night.

Buffing and the heating of shoe finishing tools are the principal hazards of the finishing department. A number of fires have occurred in the blower systems used to remove the chips and dust from the machines. While the cause of these is indefinite, many are thought to have been caused by matches or burning cigarettes dropped into the pipes by the employees. The finishing of heels and soles is done by heated tools called "kit tools," and the uppers are usually ironed smoothly onto the lasts. In many factories these tools are heated over small oil stoves or lamps, and the danger of tipping the lamps or stoves over constitutes the principal hazard. Where used they should be securely fastened to the bench. Electrically heated smoothing irons are now extensively used, and this method is a great improvement over the old methods. It is necessary to provide a rest for electrically heated tools in order that they shall not overheat and set fire to the bench, and it is well to install a red pilot light in the heating circuit to show when the current is turned on.

Some inflammable cleaning materials are used occasionally at the treeing benches, and fires due to carelessness at times occur here. Naphtha should always be used from safety cans.

RUBBER CEMENT AND NAPHTHA.

The largest single cause of shoe factory fires is rubber cement, Naphtha in the finishing room has caused 3 per cent., and naphtha blacking $2\frac{1}{2}$ per cent. of them. It is therefore necessary that special safeguards and rules should be made to protect against their hazardous nature. Carelessness is to blame in almost every case, and the following rules should be rigidly followed if safety of life and property are to be secure.

The main supply of cement and naphtha should be kept in a cement house 30 feet from any important building, and it should

be, if possible, constructed of non-inflammable material. No lanterns should ever be used or matches lighted in this house.

All naphtha and cement should be drawn by a responsible person, and carried to the rooms where they are needed in not larger than 5 gallon covered cans.

At the close of the day all cement and naphtha except that contained in the closed tanks at benches and machines should be collected and removed to the cement house.

Never allow more than one day's supply of naphtha or cement in the factory at a time. (This clause is invariably incorporated in every insurance policy covering shoe factories.)

Never use cement or naphtha compounds near an open light.

CONCLUSIONS.

This description includes all the important processes and their attendant hazards which are found in the ordinary shoe factory. In conclusion it may be said that if carelessness, either malicious or thoughtless, could be eliminated, there would be at least 50 per cent. less fires than now occur. Many manufacturers are blind or willfully careless in the matter of properly safeguarding the hazards of their business, and it is the duty of enlightened people to educate such manufacturers, and enforce, if necessary, such safeguards as experience has proved of value.

RUBBER MANUFACTURE.

The Processes and Fire Hazards Attendant Upon the Manufacture of Mechanical Rubber Goods, With Suggestions for Minimizing the Fire Dangers.

By L. Alexander Mack, of The Weekly Underwriter Staff.

Rubber manufacture, as carried on in this country, is divided by the manufacturers themselves into five main groups, each of which differs so materially in the processes employed, as to form practically five different industries. In fact it is very rarely the case that a rubber factory engaged in one line of the industry branches out successfully into any of the other four. These five main branches comprise respectively the manufacture of: (1) Clothing, (2) Boots and Shoes, (3) Mechanical Rubber Goods, (4) Druggists' Sundries, and (5) Tires.

It is the purpose of this article to deal only in a general way with the cultivation of rubber, but specifically with the manufacture of mechanical rubber goods.

THE CULTIVATION OF RUBBER TREES

for commercial purposes is most extensively carried on in Brazil, South Africa and the Straits Settlements. Buyers of crude rubber, however, prefer that from the wild trees, since planters have not yet been able satisfactorily to analyze the soil in the African forests so as to duplicate it on plantations. Cultivated rubber trees require about the same care as orange trees, and may be tapped when six years old. Their life, under favorable conditions, is practically indefinite. No one knows the age of the wild trees in the African forests.

In the manufacture of rubber the process really starts when the native grower taps the rubber tree, collects the sap in his gourd, and at nightfall brings the full gourds to his camp. Building a fire in a conical furnace, he dips a paddle into the sap, and revolves it over the furnace until the sap has fairly coagulated. This process is repeated over and over until the mass of crude rubber on the paddle assumes the appearance of a ham, when it is ready for shipment. This process is assisted in South America by the use of a native nut, which is burned in the furnace. The fumes of this nut contain creosote and

other ingredients, and impart a preservative element to the raw rubber.

The African and Indian rubber juices are usually coagulated by pouring in solutions of acetic acid, alum, salt, ash, lye, or certain plant juices and kneading the mass into balls which are porous and wet. Rubber manufacturers prefer the Para hams which are coagulated on the paddle as first described, as it is claimed the acids used in the African process are injurious to the rubber.

Crude rubber reaches this country in a variety of forms, usually, however, in what are termed "hams," possibly because of their shape, or smell, or both. Frequently, too, the hams contain any amount of water, earth, sand, stones, and even an occasional half-brick which the innocent native inserts to add to the volume of rubber production of his camp.

When the "hams" reach the rubber factory they are usually stored in a cool place until needed.

THE FIRST PROCESS.

Crude rubber is quite hard when cold, but becomes soft and sticky when warm. In the manufacture of rubber the first step is to remove the mechanical impurities and to "break down" or soften the hams by "boiling" them in large vats of warm water. "Boiling" merely consists in keeping the rubber in these vats from twelve to twenty-four hours. They are then ground between corrugated rollers into thin sheets, while streams of warm water play over the mass from perforated pipes above the rollers. This thoroughly removes all impurities. The raw rubber is then thoroughly dried by a vacuum process, and stored in a cool, dry, dark place until ready for

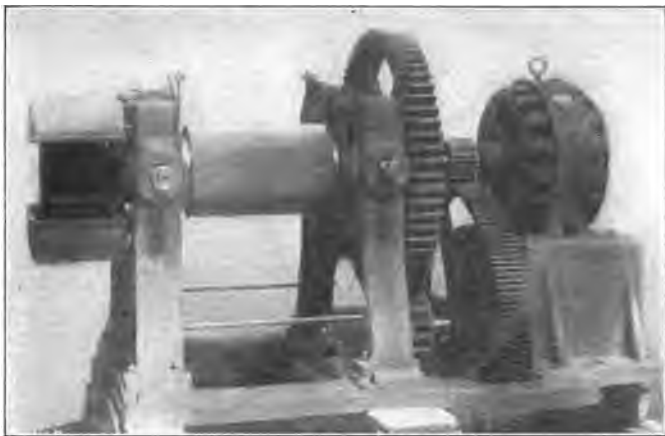
MIXING.

The next and most important step from the viewpoint of the manufacturer is mixing. At this point the manufacturer introduces almost any kind of ingredient with the raw rubber to meet the demands to be put upon the finished product. Some products are to be subjected to more severe wear than others. Some require greater resiliency, others a peculiar consistency. Some are to stand heat or cold, or require varying compression or tension qualities. Here also the coloring matter is introduced. It is in the mixing, therefore, that the manufacturer shows his greatest skill. The secrets of the trade are here well guarded.

The chemicals used in mixing are stored in a room in large bins, usually numbered or lettered so that even the employee who actually makes up the mixture is in ignorance of the exact nature of the ingredients, knowing them only by the number or letter on their respective bins.

A word as to the nature and uses of the various chemicals

used in the mixing process. Rubber itself is a hydro-carbon of somewhat uncertain composition, as its exact analysis presents peculiar difficulties to the chemist. The leading article on the subject in the "Encyclopedia Britannica" gives its symbol as probably $(C_{10}H_8)_x$, but states that there are no data for the determination of the value of x in this formula. Undoubtedly all the varieties of rubber are terpenes or polyterpenes, which, under the influence of atmospheric oxygen and



WASHER WITH ELECTRIC DRIVE.

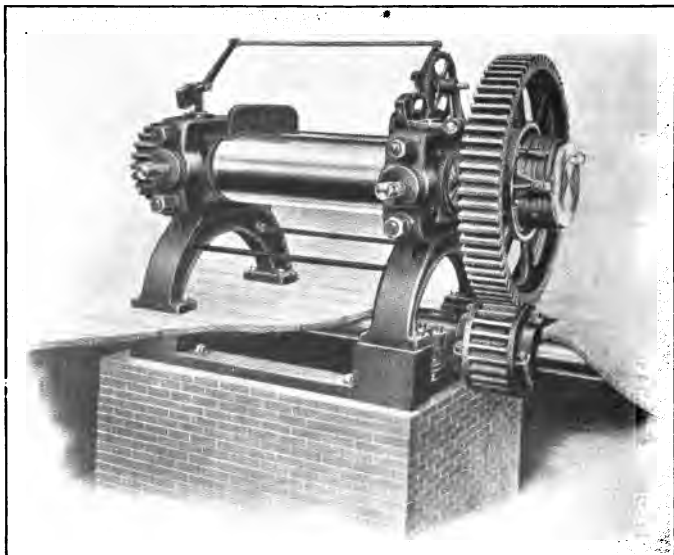
Courtesy Birmingham Iron Foundry, Derby, Conn.

light, partially change into resinous bodies, and yield the rubbers of commerce.

Next to the rubber itself, sulphur is the most important ingredient of all in the rubber mixture, and by its use the practically endless varieties of substances adapted to make objects of every description has been rendered commercially possible. If rubber is mixed with either pure sulphur, the alkaline sulphides, the sulphides of alkaline earth, the metallic sulphides, or chloride of sulphur, and the mixture heated, the sulphur is more or less absorbed. According to the quantity of sulphur absorbed and the degree and amount of heat to which the mixture is exposed, the rubber becomes transformed into more or less hard and elastic substances, named, in accordance with the existence of these qualities, vulcan-

ized rubber, hardened rubber, vulcanite ebonite, etc., and all these substances are entirely free, within a very large range of temperature, from the disadvantages inherent in raw rubber.*

Other chemicals frequently used for coloring, and other qualities which it is desired to impart to the mixture, are litharge, whiting, paraffin, lamp-black, antimony, zinc oxide, barium sulphate, lime, etc.



MIXING MACHINE.

Courtesy of the "India Rubber World" of New York.

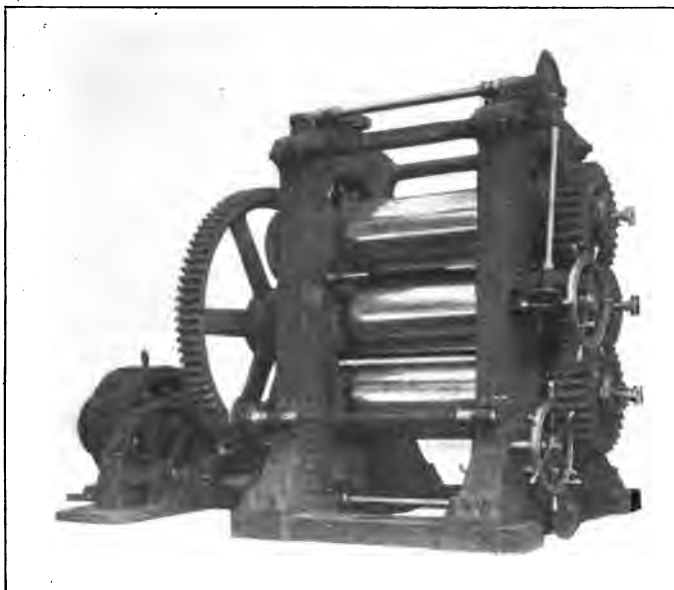
When the chemical ingredients have been mixed according to specifications, they are placed in a box together with the raw stock with which they are to be mixed, and are conveyed to the mixing room. Here are numerous

MIXING MACHINES.

each consisting of two horizontal rollers of different diam-

* India Rubber and Pneumatic Tire Factories, by Robert Cumming, Insurance Society of Edinburgh, November 15, 1904.

eters. They are heated by steam and revolve at different speeds. The mixture of pure raw rubber, reclaimed rubber and chemicals is fed into the rollers until thoroughly masticated. The mass of rubber adheres to the smaller roller, and that part of the chemical mixture which passes through the rollers without being entirely absorbed by the rubber is caught in a large pan beneath and poured back until all is entirely in-



THREE ROLL CALENDER, MOTOR DRIVEN.

Courtesy Birmingham Iron Foundry, Derby, Conn.

corporated into the rubber mass. The operative then inserts a knife into the mass, peels it off the roller and it is ready for the next process.

CALENDERING.

Calendering is the process by which the raw rubber mass is freed of any bubbles, and rolled into a smooth sheet of uniform thickness preparatory to its application to any of

the myriad of uses to which it subsequently may be put. The calender consists of a series of steam heated rolls, revolving under pressure. The raw or "block" rubber is passed into the calender from one side, whence it is worked by the



HYDRAULIC PRESSES IN OPERATION MAKING MOLDED GOODS.
*Courtesy of the Manhattan Rubber Manufacturing Company,
New York.*

action of the rollers into the desired thickness and width. There are also friction calenders in which the rolls revolve at different speeds, and which are usually employed to apply a thin sheet of rubber to cotton duck for the manufacture of

fire hose, transmission belts, etc. In any of the products in which rubber-lined cotton duck is used, the duck is first thoroughly dried by passing it over a series of steam-heated rollers. The rubber is calendered into long sheets the same width as the duck. The rubber and duck are then passed through a friction calender together, being fed in from opposite sides, under heavy pressure and with heat. This forces the rubber into the fabric of the duck. The material is then ready to be cut into strips for belting, hose or similar products.

MOLDED GOODS.

Plain calendered rubber without the duck backing is cut into various shapes for mats, shoe soles, corks and washers, either by hand or by special tools. These pieces are then placed in molds and the mold placed in a hydraulic press the plates of which are heated by steam. The pressure is then applied, and this with the heat of the plates completes the vulcanization.

RUBBER HOSE.

Rubber hose is made by passing uncalendered rubber, just as it comes from mixer, through a "tubing machine," heated by steam. This machine is much like a sausage machine, turning out a long tubular product which is cut to the required length. Soapstone is blown through it to prevent adhesion, and a pole is then introduced at one end, the tube being held open by means of compressed air applied at the opposite end. Strips of cotton duck coated with rubber cement are then placed parallel to the rubber-covered pole, and the whole is placed over a series of rollers. Pressure is applied for a moment and the "pole" emerges from the "wrapping machine" with the duck neatly wound around the rubber. Some grades of hose are wound by hand. The hose is then vulcanized, cut into shorter lengths if required, fitted with couplings, baled, and is then ready for shipment. Jacketed hose is similarly prepared, except that after being partially vulcanized and removed from the pole, the rubber tube with its cotton duck lining is coated with rubber cement and inserted into the jacket by means of a "go-devil," "mouse" or "rat"—an ingenious mechanical device—after which steam heat is applied from within, under pressure, forcing the rubber cement into the fabric of the jacket, and completing the vulcanizing process. Some mills weave their own hose jackets. Here will be found the fire hazards of the textile mill, chiefly from oily litter on floors.

Belting is made by "building up" strip on strip of rubber lined cotton duck, coated with rubber cement. This is then

run through stitching machines, rolled and vulcanized, and is then ready for shipment.

Rubber rollers for the paper trade are made by wrapping calendered rubber around a core until the proper thickness has been obtained. The roller is then passed through a "buffing machine" consisting of a rapidly revolving emery wheel which planes and polishes the rubber surface, after which the roller is passed into the vulcanizer.

In the manufacture of door mats, automobile mats, rubber soles for shoes, rubber washers, etc., the calendered rubber is first cut to the desired shape, either by hand or by means of a mold, then placed in a mold of the desired shape and passed into the vulcanizer.

Mosaic work is done by first spreading a sheet of rubber-



VULCANIZERS, READY TO RECEIVE RUBBER ROLLS MANUFACTURED
FOR PAPER TRADE.

*Courtesy of the Manhattan Rubber Manufacturing Company of
New York.*

covered cotton duck with a coating of rubber cement, upon which the design is placed by hand. When thoroughly "set" the whole is placed in the vulcanizer.

VULCANIZING.

Vulcanizing is the finishing process through which every product must pass. By this process the rubber is given

"life," resiliency, brilliance, "snap," strength and innumerable other qualities which prior to vulcanization are latent in the chemical ingredients of the rubber compound.

The process of vulcanization consists of applying heat and pressure. The vulcanizing machines vary in external ap-



VULCANIZER.

Courtesy Biggs Boiler Works Company, Akron, Ohio.

pearance according to the article to be treated. Hydraulic pressure is used for smaller products made direct from calendered or laminated rubber. Steam pressure is used for hose, rollers and similar products. Steam heat is universally

used, the degree of heat and pressure required depending largely upon the article to be vulcanized.

RECLAIMING OLD RUBBER.

One of the most important branches of the rubber industry is the reclaiming of old rubber. There are numerous machines on the market for separating the rubber from cloth or metal backing, after which the rubber is treated with nitric or sulphuric acid or caustic soda, which eats out all fibre. The mass is then placed in a devulcanizer (similar in appearance to a vulcanizer), and steamed. It is then dried, ground fine and stored until ready for use in the mixing machines.

THE FIRE HAZARDS.

The greatest hazard in the manufacture of rubber products is not the rubber itself but its solvents. "Rubber cement," as it is commonly called, is composed of pure rubber, cut fine and softened in carbon dioxide, after which this mixture is dissolved in benzine, making a powerful adhesive. The dangers of volatile fumes of benzine are well known to every underwriter, and the danger from careless use of rubber cement cannot be too strongly emphasized. The inspector should devote particular attention to this material, first, as to its storage, and, secondly, as to its actual use. It is worth noting, however, that once the cement has been applied and becomes dry the danger point appears to have been passed.

STORAGE OF RUBBER CEMENT.

Manufacturers realize that with a costly product like rubber cement it is important that every gallon purchased should be used. This result cannot be obtained when the wooden barrel which has served for its transportation is afterward used for storage. Such a barrel is more or less porous, and so in the best plants the cement is at once transferred to metal tanks, buried underground at least thirty feet from any building. This is the only safe and approved method of storage of rubber cement. The inspector should satisfy himself that only a day's supply of cement is kept in the factory at one time, and this must be kept in self-closing metal cans. It seems almost needless to say that smoking should be prohibited within any portion of a plant where such material as rubber cement is used in almost every department.

STATIC ELECTRICITY.

Next to the hazard of rubber cement is the danger from static electricity. Instances are of frequent occurrence where in moving a sheet of rubber-lined cotton duck or belting across a table top enough static electricity is developed to generate a good sized spark. This is extremely dangerous

if there is any rubber cement nearby. The best safeguard against this hazard is to have all tables in this department "grounded"—a simple expedient within the reach of every manufacturer.

BUFFING.

Some attention should be given to the department where buffing is carried on. The fine dust, here given off, though composed partly of rubber, has an admixture of lint from the buffing wheels themselves. This finely divided material if allowed to accumulate would make an excellent subject for spontaneous combustion, especially if left where any grease or oil could drop on it. Complete blower systems should be installed to carry the dust direct to the boiler room, where it should be destroyed as soon as practicable. There is very little danger of the friction of the buffers developing enough heat to set fire to any fumes of benzine in this department.

STORAGE AND WASHING.

The storage of crude rubber under suitable conditions does not present any undesirable features from the underwriter's viewpoint. Nor does the process of washing, for, in spite of the frequent presence of foreign substances, water is so necessary an adjunct to this process as to make fire an impossibility at this stage of the work.

CHEMICAL ROOM.

The chemical room should be carefully inspected to make sure that all chemicals are stored in standard self-closing bins of lock-jointed tin. The best mills store their chemicals in a separate building from which the boxes containing mixed chemicals and raw rubber stock are conveyed by a belt to the mixing machines. Lampblack is a decidedly dangerous substance, composed almost entirely of carbon. If it becomes damp it will heat up sufficiently to char its paper wrappings, or the paper linings of barrels in which it is shipped, and if left long enough will eventually set fire to the barrel itself. Barium sulphate is a rapidly oxidizing metallic substance which is a frequent source of trouble if allowed to become damp; carbon disulphide is a liquid similar to benzine in its volatile and explosive qualities. There is danger also from unslaked lime becoming slaked and setting fire to things about it. Sulphur is not bad, and there is no danger from whiting, paraffin or litharge.

MIXING AND CALENDERING.

In the mixing process the underwriter will find little or no special hazard, as a high temperature would spoil the rubber. The temperature of the mixing rollers is maintained at about

176° Fahr., and steam heat is now almost universally employed.

VULCANIZING.

The fire hazard from the vulcanizers themselves cannot be said to amount to anything more than the usual steam pipe hazard, steam being the medium now employed in vulcanizing in practically all factories. With the boiler house properly isolated and the vulcanizers set on metal, and with all surrounding woodwork protected with metal sheathing, the hazards of the vulcanizer can be reduced to a minimum.

RECLAIMING HAZARDS.

The hazards of the reclaiming house are chiefly those of the storage of chemicals. Sulphuric acid, nitric acid and caustic soda are the chemicals principally used. All are dangerous unless kept in approved receptacles, preferably in a detached building. The machinery and arrangement of the reclaiming plant present no more serious hazard than that the floors must, of necessity be pierced in numerous places to facilitate the handling of the reclaimed material, thus making a total loss on this structure a high probability if fire once gets a start.

MISCELLANEOUS.

As before indicated, the hazard of oily waste and lint is to be looked for in the department where jackets are woven for hose. Self-closing metal cans should be provided for waste in this department. Large plants frequently run their own printing establishments, the hazards of which have been pointed out in another article in this series. Benzine is the dangerous substance here, and should be kept in patent safety cans and only a day's allowance kept in the shop at one time.

OTHER RUBBER INDUSTRIES.

While this article will not deal with the hazards to be found in factories making rubber clothing, boots and shoes, tires and druggists' sundries, it will be well to note that the hazard in the clothing industry is chiefly in the spreading of the daub, which is virtually a rubber cement mixture. Static electricity is the dangerous feature here. In the boot and shoe industry the lacquering room seems to be the source of most trouble. Here the lacquer, composed of highly inflammable materials, is "slathered" over the boot or shoe by hand, and the article is at once put on a rack and taken into the drying room, where a high temperature prevails. Trouble may frequently develop here.

FIRE PROTECTION.

A full equipment of fire pails, extinguishers, standpipe and hose, and, above all, a thorough sprinkler equipment, will do much toward making rubber works profitable to the underwriters. Good housekeeping is, of course, an essential to every well organized factory, and should be insisted upon by the inspector at all times.

In closing we desire to acknowledge the courtesies extended to us in the preparation of this article by the Manhattan Rubber Manufacturing Company, the *India Rubber World*, the Insurance Society of New York, the Biggs Boiler Works Company of Akron, Ohio, and the Birmingham Iron Foundry of Derby, Conn.

PIANO FACTORIES.

Elaborate Description of the Processes and Fire Hazards of This Type of Risk.

*By Louis Harding, Special Agent Improved Risk Department,
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The piano as we find it today represents the genius of hundreds of men extending over a period of many centuries, its mechanical development is intensely interesting, and a brief summary is here given showing how from an extremely simple instrument of very limited capacity it has grown into one of mechanical perfection and wonderful possibilities.

The monochord is the first instance of a musical instrument where strings were made to vibrate on a supporting bridge over a sounding board. It had but one string and various notes were produced by shifting one of the bridges. The dulcimer is one of the oldest predecessors of the piano, and consisted of a box strung with wires that were hit with hammers; an ancient Assyrian bas-relief shows one in use, the psaltery is quite similar, but in this case strings were plucked with a plectrum. Little improvement was made till the twelfth or thirteenth centuries, when keys were introduced. The exact time of their introduction is difficult to trace, but small organs which were played with keys were used in Germany in the thirteenth century. Organs had been used many centuries before this, but had been played with sliding rods or stops, only one sounding at a time. It is through the introduction of the keyboard that the forerunners of the piano and the piano itself came into existence. Following the psaltery came the spinet, in which a quill or thorn was fastened to one end of a jack adjusted on a lever or key and set the string vibrating by snapping it as it passed, when key was pushed up or down; there was but one wire for each key. The virginal was a modified form of the spinet, and was in quite common use in the sixteenth and seventeenth centuries. The clavictherium was invented in Italy, about the fourteenth century. Strings were made of gut. The harpsichord was an enlarged form of the spinet and virginal, first appearing in Italy and being in quite general use toward end of sixteenth century. The strings were made of steel or brass wires, and differences of forte and piano were produced by use of swell boxes, stops and sometimes a double row

of keys; one with stiff quills, the other with soft. There were from two to five strings for each note, and by use of stops the additional strings could be coupled to fundamental note. In the clavichord an entirely new idea was introduced; strings instead of being plucked were struck by small brass tangents at the ends of the keys which acted as both hammer and bridge. The brass tangent had to be held against the wire as long as sound was desired. It did not possess the power of the harpsichord, but was the direct forerunner of the piano, embodying the idea of the piano action.

Bartholomeo Cristofori, of Florence, Italy, is called the inventor of the piano, and is reported to have exhibited several in the year 1709. The action used in his piano was crude, but it was he who adopted the idea of impelling a hammer head toward the wire, then allowing it to immediately rebound while the string continued to vibrate. No damper was used. At first there was great difficulty experienced with the escapement. In latter part of the eighteenth century improvements were rapidly made in Germany, France, England and in America in the early part of the nineteenth century. As more and more power was demanded from the instrument the makers used heavier construction features, until in 1825 the cast iron plate was invented for square pianos. The method of "overstringing" wires was adopted, after which improvement was chiefly in the individual ideas brought forth by the different manufacturers, many of whom soon sprang into existence, until piano manufacturing became one of our great American industries.

PROCESSES.

All the parts assembled in a piano are not ordinarily made by the firm under whose name the instrument is sold; piano case, key, action or hammer making being each carried on as a distinct business, and the work of many manufacturers is reduced to finishing the cases, setting up, assembling, adjusting the actions, tuning and voicing. The iron plates are almost invariably cast at foundries that make a specialty of this work, and finish of same may or may not be done by piano manufacturers. It is only in the largest plants that we find the metal parts, such as pedals, casters, binders, special bolts and screws, being manufactured.

There is considerable variety in the method of progression employed by the various makers, although in the main features it is necessarily very similar. We will not attempt to give the exact method employed by any one firm, but at the same time try to give an accurate idea of how various parts are worked together to produce the finished piano. There is a great difference in the time allowed by the makers of cheap and the makers of high grade pianos, the former rushing work through rapidly as possible, while the latter allows six to twelve months for each instru-

ment. Both grands and uprights are made by most large concerns, and while the cases are very different in construction, the rest of manufacture is practically the same.

WOOD IS THE FIRST ESSENTIAL,

and all the large makers have their own lumber yards. Lumber must be air dried for at least a year (often two or more), after which it is put in dry kilns, temperature ranging from 110 to 170 degrees Fahr., and is left here from three to six weeks.

Lumber is brought to the mill room, where it is sawed and planed into the desired sizes; many parts are made of quarter sawed pieces, glued together, so there is considerable gluing done here; parts are piled on trucks and then taken to case making room.

CASE MAKING.

The wooden portions of a grand piano are referred to in a general way as consisting of the case and trimmings. The case includes the rims with the supporting beams or braces within, the legs and pedals. The rim is made of continuous pieces of wood veneer (usually maple) from $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, glued together; every grand piano has an outer and an inner rim, each glued separately in forms and then the two are glued together. Outer rim varies in thickness from $\frac{3}{4}$ to 2 inches, the inner from $1\frac{1}{4}$ to 3 inches, the number of thicknesses used varying according to the thickness of the rims and the thickness of the veneer. Inner rim is not so deep as outer, thereby forming a shelf around the entire inside on which rests the sounding board and iron frame. The outside finishing veneer is applied at same time when forming is done. After forming, rims are piled in tiers and allowed to remain for several months before trimmed to proper size. Few people have any idea of the importance glue plays in the construction of a piano. Practically everything is glued, as there is then no chance for rattling or working loose of bolts or screws.

The supporting posts or braces are located inside the rim, being made of a single piece of wood or several pieces glued together and of varying sizes and shapes, but all arranged to securely support the rim and form the main body of the instrument. Great strength is necessary, as posts receive the direct tension of the strings conveyed through bridge to sounding board and prevent the iron plate from buckling. One of the best makers employs only two wood braces placed in "V" shape, and uses in conjunction six heavy steel adjustable braces.

The trimmings include the top, fall board, music rack, key strip, key blocks, etc., all made in the mill room and then veneered. The wrest plank or pin block into which tuning pins are to be set is next attached to case at front end. Its construction is of the greatest importance, for if not well made piano will

not remain in tune. It is composed of separate thicknesses of hardwood, usually rock maple glued one upon another, so that grain of each crosses at right angles the grain of layers directly above or below. Wood is carefully selected and seasoned, and great care taken in the gluing and final finishing. It is usually trimmed to exact size in milling room ready to set in place in case room.

IN SPEAKING OF UPRIGHT PIANOS,

makers refer to the skeleton, the case and the trimmings.

In the upright there is no rim made of veneered wood, and the skeleton is designed to perform the duty of posts and rim in the grand. It consists of uprights or standards, made either of a solid piece of wood or of glued-up pieces, and spaced varying distances apart, the better pianos having three to five good stout uprights, while a cheap piano would have perhaps a greater number, but lighter and made of cheap cull lumber veneered over or painted to hide the many imperfections and knots. Filling blocks made of glued-up pieces are placed between the uprights at top and bottom, and after glue has set the edges are trimmed to exact size.

The wrest plank, made in same manner as for grands, but of different size and shape, is attached to front of skeleton at top, being securely glued into place.

The case in an upright means the ends and the protruding sections (called "cheeks") that form the end of key bed. These are made in milling room of solid or "blind" wood that is veneered. In a good piano the best quality ash, pine, whitewood or chestnut is employed for blind work. In a cheap piano any kind of common and cull lumber with all kinds of imperfections is used.

Trimmings include top, front frame and panels, fall boards, lock rail, bottom frame, base rail, key blocks, etc. (Trusses may or may not be included in trimmings). All these parts except the trusses are made of blind wood that has been veneered.

VENEERING.

Practically every piece of exposed wood used in a piano nowadays is double veneered on blind wood to withstand climatic changes of swelling and shrinking, so that veneering becomes an important part of the manufacturing. All kinds of wood veneers are used, although mahogany is the wood in greatest demand, and walnut is also quite extensively used. Black or ebonized cases are made of plain hard mahogany stained with logwood. Veneers cut for the piano trade may be either sawed or shaved, the latter being thinner and about one-third the cost of the sawed veneer. In many factories an under veneer of whitewood is first applied, given about two weeks to dry, and then grain of outer veneer

is applied, so as to run across the inner grain, but the best factories use mahogany for under veneer.

Veneers are bought in large sheets of desired thicknesses, and a large quantity will usually be found on hand; value being large and varying with quality of veneer used. The value of veneer varies from 1 cent per foot, or even a fraction thereof, to 30 and even 50 cents per foot.

First process is to cut, fit and match the pieces, so as to obtain a handsome grain effect and insure as even a coloring as possible. Although almost impossible to detect in the finished piano, a great deal of piecing is done.

There are special cauls and presses for all the various parts of case and trimmings, in most cases both the metal or wood cauls; and the blind wood is heated in the caul boxes, and in all cases the glue applied quickly before heat is lost; parts then are piled in presses, where very heavy pressure is obtained either by hydraulic presses or iron clamps. Forms must all fit closely in order to leave veneer perfectly flat and without blisters. After coming from presses they are piled in racks for several weeks in order to become thoroughly dry. The large tops of grands are put in heavy presses that have about forty upright screws, each requiring separate adjustment. The next process is

SANDPAPERING,

and while this is largely done by hand some manufacturers employ sanding machines for part of the work. A belt of sandpaper is often used or a sanding machine with three revolving cylinders of sandpaper (coarse, medium and fine), the piece being carried through machine by the operation of steel cylinders. At the time sandpapering is done small holes or checks are frequently discovered in the wood, which, if left, would cause blemishes. A special shellac is used to fill these up, and when cleverly applied is said to escape notice. If decorating strips or scrolls are to be used they are glued onto panels and then finished off by hand carving.

PIANO CASE FINISHING

is practically identical with the finishing processes found in any high grade furniture factory, but in the highest grade pianos is carried out to an even finer state of perfection. It comprises the following: staining, filling, varnishing, rubbing, flowing and final finishing.

Staining.—The cases and trimmings come to staining room in the white, and are here stained (by hand brushes) with aniline colors or potash mixed in water. The manufacturers of some of the cheapest grade pianos use an alcohol stain which does not penetrate into the wood, thereby eliminating sandpapering. After staining, parts are set in racks and left stand-

ing from twenty-four hours to three weeks before filling, according to the idea of manufacturer, and are then sandpapered by hand with fine paper.

Filling.—This is next applied, a good liberal coat being given by hand brushes, and the parts are set on racks to dry. The surplus filler is wiped off by either rags, coarse waste, excelsior or sea grass, and there is frequently a considerable quantity of any of these about filling benches. After filling, parts are left to dry atmospherically, the time varying from two days to three weeks.

Varnishing.—All high grade piano makers give four or five coats of varnish to the entire case and an extra coat to the trimmings before the pumice stone rubbing process. The length of time allowed for drying and setting between coats varies considerably, but is generally eight or ten days between first and second coats, and four to eight days between second, third and fourth coats, this drying all done at ordinary temperatures, no heat used. In the cheaper grade of pianos, where the idea is to hurry out the work as soon as possible, they allow only from two to four days between coats, and sometimes dry rooms are used to hurry this process, temperature being only slightly raised, about 80 degrees Fahr.; also some quick drying varnishes are employed where after the first coat has been given the second, third and fourth can be applied every other day. In all piano factories the varnish rooms will be found filled with cases, partly or entirely set up, and sets of trimmings on movable racks. Oily rags will always be found here, and their disposition is of the greatest importance.

The manufacturer of a high grade piano wishes to obtain a very high and lasting polish, and to insure this never hurries the varnishing process, for if he does, one of the under coats is liable to shrink after final coat has been applied, and this would bring disastrous results. Climatic conditions enter largely into this part of the manufacturing; therefore when weather is damp and muggy a longer time is necessary for the drying. Usually four weeks is allowed after last coat of varnish before the rubbing is commenced.

Pumice Stone Rubbing.—The cases and trimmings are next taken to the rubbing room, where each piece is carefully rubbed with ground pumice stone, wet with water; a small piece of cork covered with felt is used for this work. Rubbing is mostly all done by hand, although some makers use power machines for the large flat pieces, such as tops of grands. Hand work is far superior, and naturally more expensive, as it takes from two and one-half to three days to rub a large grand piano. After rubbing the parts are washed with sponge and water, then wiped off with chamois. Here again the time allowed before the next process, flowing, varies from about three days to three weeks.

Flowing.—This is the term used to signify the final coat of varnish, this work being always done in a room that is carefully partitioned off and kept immaculately clean. In some factories the floors are oiled to keep down the dust, very small particles of which would be evident and prevent a perfect finish. It is said to be very difficult to find men who can do first class work, perhaps not one in a hundred fairly good varnishers can do the flowing properly. Parts are given time to become thoroughly dry and then are ready for polishing.

Polishing.—The term "polishing" is used in the piano trade to include: (1) The second pumice stone rubbing which is given after flowing; (2) the rotten stone rubbing, which is given to take out the pumice stone scratches and prepares for (3) the hand rubbing. The latter process produces the final polish and is a very laborious piece of work; however, nothing has yet been discovered as a substitute for producing the high polish thus obtained. The men who do this work must take excellent care of their hands and are considerably troubled with atmospheric conditions; although hands must be soft, a great deal of strength is also necessary. This completes the finish of the piano case and trimmings, except for the final cleaning that is given just before instrument is shipped.

SOUNDING BOARD.

The sounding board, also called the "belly," is decidedly the most important part of the piano, and without the most careful construction a fine tone is impossible. The choice of the wood is of the greatest importance; it must be thoroughly dried (very often five years or longer allowed). The woods used are spruce or spruce pine, largely on account of their great elasticity, and the strongest possible grain is selected. Boards in the rough are about $\frac{1}{2}$ inch thick. Edges are first carefully glued together, the grain of wood being always arranged so as to run diagonally across board; then boards are planed, sandpapered and cut to desired size and shape. Thickness of finished board would be about $\frac{1}{4}$ inch in the bass to $\frac{3}{8}$ inch in the treble. Boards are then dried for a month or more, usually in hanging racks at ceiling of sounding board room, then put into the dry closet (temperature about 100 degrees Fahr.) from one to four weeks, after which the bars or ribs are glued onto back at right angles to grain of wood, and immense pressure is obtained to hold them in place by the "go-bars" (second growth ash-bars about five feet long) that are sprung in between board, as it rests on bench and special plank brace near ceiling. It is very important to obtain an arch on sounding board, the bars on the back tend to cause this, also the boards and ribs are planed off towards the edges, and sometimes the bed-board rest on which go-bars are sprung into place is somewhat depressed to help form the

arch. The wood has been thoroughly shrunk and will naturally swell in the presence of moisture, but the bars or ribs prevent swelling on the under side, and the slight swelling on the upper side is desirable for the arch. After allowing time for properly setting, go-bars are removed and bridge (built up from several thicknesses of rock maple glued together) is glued on top of sounding board.

This brings us to what is known as the "scale," and determining the scale is one of the difficult problems the manufacturer has to solve. The term scale is used to signify the relative lengths and sizes of the wires (which when struck produce the notes) and the size, shape and location of the bridge which supports them, and through which their vibrations are conveyed to the sounding board. An evenly balanced tone depends largely upon the determining of these points. Bridges are next blocked, i. e., marked and cut to pattern for location of pins, sandpapered, notched, pins driven, shellacked and varnished, after which they are set in place, line strips being previously set around edges of skeleton for board to rest on. In upright pianos some makers introduce additional strips of wood (made of glued-up pieces) and attach these across corners or sometimes around entire edge of sounding board, the purpose being to give a more balanced tone. It is perhaps more of a feature than an improvement, the idea being to imitate the bent and glued-up rim of the grand piano.

THE IRON PLATE.

On top of the sounding board rests the iron plate, set on line strips that run around edge of board and weighing from about 180 to 225 pounds for an upright to 200 to 400 pounds for a grand. It is made of cast iron and must be carefully cast, as any weak spots would not be able to stand the enormous strain of the strings, which is anywhere from twenty to forty tons, according to size of piano. Large holes left in plates are merely to reduce the weight. Every manufacturer uses a somewhat different style, in some cases the plate extends over the wrest plank (holes being provided for tuning pins), while in others it does not. The introduction of the iron plate is what makes possible the powerful tone obtainable, and, as previously stated, forerunners of the piano had no such plate and therefore strings could not be drawn to such great tension. Most makers have their iron plates cast already to set into place; casting and finishing them being a business in itself. Some of the larger makers have them cast in the rough, and do the finishing themselves; also a very few makers do their own plate casting. Where latter is done the work includes casting, smoothing down and chipping, drilling holes, setting in bottom pins, japanning and finishing. The holes for tuning pins in wrest plank are care-

fully marked by patterns; then plate is securely screwed into place, part of the supporting screws extending through holes in sounding board to the wood skeleton. It must be very securely fastened or else will tear away when strings are strung up. Besides bearing the tension of the strings the plate serves to hold the entire piano in perfect alignment.

WIRES AND STRINGING.

The notes produced in a piano are caused by the hammer striking either a single wire or what is called a unison, i. e., two or three wires tuned to same pitch. The scale, as previously stated, is produced by using wires of varying lengths and varying sizes. In order to get the desired length for bass notes wires are "overstrung" on a separate bridge, higher than that used for other strings so that these bass wires can be actually strung crossing over top of part of the strings. Eighty-eight notes or seven and one-third octaves is the ordinary number employed, but on account of the unisons it requires about 230 strings to produce them. Piano wire is the strongest known material for its size, and is also used for deep sea soundings. The heavy bass notes are made of a heavy steel body wire around which one or two smaller wires (often copper) are wound, each of these double wound wires representing a single note; the next thirteen or fourteen are made of lighter body wire that is always single wound, two of the wound wires being used for each note or unison; the remaining ones are unwound wires with three for each note or unison.

In stringing, the hitch pins (drilled into iron plate) hold the wires in place, no adjusting is done at this end; at tuning end, wires are run through eyehole in tuning pin, then are given a few preliminary turns before pin is driven into place. In order to hold wires securely in place where entering tuning pins they are either run through an agraffe or else over a rim on iron plate that is covered with a steel pressure bar.

Tuning pins are made of hard iron and are usually imported from Germany. Before actions are set in, strings are given a few preliminary "snappings" preparatory to tuning.

Hammer, action and key manufacturing are all carried on as distinct and separate branches of manufacturing, and it is only in the factories of the largest piano makers that these parts are made. When these parts are bought ready for use the piano maker's work is reduced to trimming up and adjusting them.

HAMMER HEADS

are made from a wedge shaped piece of hardwood around which two layers of thick felt are glued, except that the butt end is left uncovered. Both the wood and the felt are graduated in weight from heavy in the bass to light in the treble. The outer felt receives very hard usage, and a high grade is necessary to stand

the wear and also to produce the desired tone, for the hammer is a very important factor in the tone production. All the best felt comes from Germany, and is very expensive. Special clamps are used, into which an entire set of hammer heads is set, and the strips of felt are glued onto them under very heavy pressure, and, after allowing time for glue to set, felt is cut to size of each hammer head. To insure it from pulling away a wire is run through the ends of felt and wood core and is securely clinched.

A round shank is glued into butt end of hammer head and other end of shank is glued into action. In setting up hammers, care is taken to see that each hammer strikes wire at such a point that unharmonious overtones will be deadened as much as possible, this point being at one-eighth the length of a large proportion of the strings.

THE ACTION

includes the key and the intricate mechanism located between each key and each string or unison, which operates when key is depressed, forcing a hammer to strike that wire or unison, thus producing a note, and immediately when pressure is removed from key forcing a damper against wires to prevent further vibration. The pedal can almost be considered part of the action, as one of its functions is to prevent these dampers from operating when player so desires, thus allowing the wires to continue vibrating and produce more tone, or, again, to shift action in such a way that it will not produce as much tone as normally. The action has a long hand service to perform, and therefore should be strongly constructed, at the same time being capable of operating with the greatest ease and certainty. Grand and upright actions are quite different in design. In grands, the hammers strike the under sides of the wires, the latter being parallel to keys, and tone waves are thrown away from sounding board. In the uprights, hammers strike tops of wires that are at right angles to keys and tone waves are thrown toward sounding board.

The bass wires are heavy and long, while the upper treble wires are light and short, but the player demands that the touch be as even as possible for all notes, so, in order to obtain this result, leaden weights are embedded in the wooden keys (under ivory covering) near the front of key to make operation easier, and toward the back to make it more difficult. By the use of this method practically the same pressure can be used to produce each note.

Action making, as found in piano factories, includes light wood and metal working, mostly of a delicate nature, and the attendant hazard is light.

The woods used are chosen because of their special adapt-

ability, and grain of each piece usually runs in direction of greatest strain, except that some parts are always made with grain running crosswise, in order to avoid expansion and contraction in that direction.

There are many special machines used for cutting out and boring the small parts; the gluing of felt cushions, trimming, assembling and adjusting all require skillful workmanship. The individual parts are all made the same length between centres, so that entire set of actions can be mounted on supporting rails set into metal brackets, the latter supporting the actions in piano. When makers buy the actions ready for use they come set up in frames as just described. Hammers must always be set into actions separately when latter are being adjusted. During the action fitting, piano passes to a number of workmen, each one of whom adjusts a special part.

KEYBOARDS.

As found in piano factories where keyboards are made the process is, first of all, that of light woodworking. The wood used is generally white pine; a board is made up of several pieces glued together (size, about 5 to 6 feet long, 2 feet wide and 1 inch thick). In upright pianos the action frames, as previously stated, are held in place by four metal brackets secured to iron frame. Two of these brackets are located so that they approximately divide action frame into thirds, and, when keys are cut, the concealed ends must be sloped off to avoid these brackets. When boards are first glued together, care is taken to see that grain of wood runs as nearly as possible with the slope designed for the keys. This slope is determined by the "scale" of the instrument which keyboard is to fit.

The ivory coverings for white keys are next glued on and then shaved off till absolutely smooth and even. The front edge of nearly all piano keys is now covered with celluloid, but in the high grade pianos the tops are always covered with ivory. As it is only in the case of a high grade manufacturer that the keyboards are made in the piano factory, the celluloid hazard (meaning by this the storage of sheet celluloid, cutting, cementing and disposition of scrap) is practically eliminated from piano factory. This would not be true of a keyboard factory, for there a large number of celluloid covered keys would doubtless be made. An ivory key can easily be distinguished from a celluloid key, viz., when made of ivory two pieces are required to cover each key, pieces being joined on a line with front edge of "sharps." For celluloid tops, only one piece is used, being sometimes merely "lined across" in imitation of the ivory piecing.

The holes for balance pins (which are set into balance rail to hold key in place at this point) and for front pins (which

hold keys in exact position at front edge) are next bored and bushed with felt, then the keys are sawed out with a band or fret saw, edges planed and ivory coverings carefully finished on all corners, trimmed and polished. They are adjusted by careful balancing of each key, the leaden weights are let into keys at this time and felt pads provided at bottom of each pin. Sharps are made separately, the best ones of ebony, although stained and japanned sharps are used in a great many pianos.

THE PEDAL ACTION

is simple, consisting merely of rods and levers, attached to the action frame, that operate when pedal is depressed to shift either all or part of the actions, as desired.

The function of the pedals has already been referred to in its close connection with the action. A few words will explain the operation of pedals and difference between the grand and upright pedals. In the grand the right hand pedal (called either loud or forte) when depressed lifts the dampers off strings, holding them away and permitting each note to continue vibrating until foot is removed. The additional tone is produced by the sympathetic vibration induced in the strings not struck. These vibrations are always present in a piano, but more apparent when dampers are off the wires. In the upright exactly the same operation is performed, although, of course, mechanical arrangement is different. In the grand the left hand or soft pedal shifts the entire action toward the right, so that the hammers strike only two strings in the unisons of three, only one in the unison of two, and in the bass notes strike on the side of the hammer instead of in the centre. In an upright the soft pedal does not shift the action, but brings the hammers nearer to the strings, making less leverage, and consequently a softer tone is produced. Middle pedal is designed to perform various uses, and is frequently known as the tone sustaining pedal, and allows one note to continue vibrating while dampers operate on all the others.

TUNING.

The number of tunings given, and the length of time allowed between each, varies with the grade of the piano. A high grade piano will be given a dozen or more separate tunings. The atmospheric conditions will have a great deal to do with this, for in damp weather strings will not stay in tune. It is claimed that a grand will remain in tune longer than an upright, due largely to the fact that the strings of a grand, being horizontal, are all in the same strata of air, while in the upright, where the strings are perpendicular, they may be subject to very different degrees of heat and moisture. The preliminary tunings are frequently given by boys or men of little experience (especially in low class instruments). The final tunings must be done by experienced

hands and ears. After the tuning comes the very delicate operation of

VOICING,

and in this operation the beauty of tone can very often be either made or marred. Although it appears to be a most simple operation, the greatest skill is necessary to make the work a success. It simply consists of plucking the felt hammer heads with three fine steel needles until the felt is rendered just soft and springy enough to produce the desired tone. It takes twelve to thirteen hours for the first voicing, after which the felt hammers are scraped off with sandpaper, and then the second voicing requires five to six hours, being a repetition of the work previously done, and renders the felt of the proper softness to produce a mellow tone when hammer strikes wires. One of the chief objects in this operation is to kill the unharmonic overtones, and the picking of the felt causes the hammers to remain longer on the strings, thus dampening the harsh overtones.

INSPECTING, TRIMMING, FINAL CLEANING.

The piano is now practically completed and is carefully inspected, after which the trimmings are permanently set into place (having been previously fitted), then the case is gone over and given a cleaning with a little alcohol on a piece of chamois, then a little lemon oil, perhaps, thinned with turpentine.

The best manufacturers keep the finished pianos stored in the factory from six months to a year. Often they are kept longer, and are given several tunings during this time. Naturally a manufacturer who is rushing the work through as rapidly as possible will not trouble to do this. Careful, conscientious work from beginning to end is the only way to produce a high class instrument, and the attention that is paid to every detail in a high grade piano factory is remarkable.

The careful work necessary on all parts of a piano doubtless has a great moral effect upon the men employed in this line of manufacturing, and consequently educates them to exercise care in other ways, which noticeably includes the prevention of fires.

Taken as a class, the number of fires reported is not large, and the losses paid are ordinarily not heavy, even with the large values represented, this being particularly true with the properties equipped with sprinklers. Heavy water damage is possible, but this is somewhat offset by the fact that the great majority of fires reported start in sections necessarily separate from the finished piano storage sections and therefore not entailing as heavy a loss as might be expected. Piano manufacturing presents

FEW SPECIAL HAZARDS

peculiar merely to this class of risk, but rather embraces the hazards of several well known classes, and the variety of hazards

found depends entirely upon the completeness of the manufacturing, as carried on in each risk.

DRY KILNS

should be located as far as possible from main factory. In city risks it is often impossible to have kilns detached, but they should be cut off in a standard manner, and should be constructed either of brick or concrete. Construction of kiln is of the greatest importance, all wood sheathing and hollow wood finish should be avoided, and if area is large kiln should be divided into sections by fire walls. Canvas curtains are permissible at loading end of kiln. Construction of ventilators is also very important. They should preferably be of metal and located in roof. Kilns should be completely equipped with automatic sprinklers, and additional protection may be obtained from live steam jets. On account of the large amount of lumber in kilns, distribution of sprinklers is considerably hampered, making use of steam jets in conjunction very desirable. Heating is either by steam or hot air. When steam heat is used pipes should be set on non-combustible foundations (ledges in brick walls are frequently employed); should be properly supported and so located that space below pipes may be easily cleaned out. Pipes should not be so near together that they will form a trap to catch refuse. Where kiln is built of wood great care must be taken to see that steam pipes are well bushed where passing through woodwork.

When hot air is used, fans should be located in non-combustible room adjoining kiln; steam coil and blower should be enclosed in sheet metal, with bearings located on outside of casing; fan room should receive special attention as regards cleanliness, care of oily waste, etc.; circulating ducts should be brick, provided with metal uptakes for each section of kiln. The method of returning air to fan for reheating is not to be encouraged, on account of the additional hazard from dust and particles being drawn into fan.

Automatic dampers should be provided in ducts and automatic device for shutting down fan. Best method of loading is by trucks which can be run in on tracks, although most ordinary method is by piling flat on strips or platforms, which should be kept safe distance from steam pipes. Kiln should be carefully watched, and cleanliness insisted upon.

MILL ROOM.

In this room are found all the ordinary woodworking processes, such as sawing, planing, turning, shaping, boring, gluing, sand-papering. Mill room must be thoroughly equipped with a modern metal blower system of ample capacity, that discharges either direct to boilers or to a standard shavings vault.

Blower pipes should be as straight as possible and without obstructions; bearings at fan should be outside and self-oiling.

Cyclone separator should be located on roof of boiler house or shavings vault, and screen provided to prevent sparks entering same. It is a good plan to run fan a few minutes after mill room shuts down, for purpose of cleaning out blower system. Besides equipping the various machines, several floor exhausts should be installed for purpose of disposing of sawdust that is swept up. The sanding machines present the most serious hazard in this portion of the factory, and special attention should be given to design of blower pipes, so that as much of the fine dust as possible may be collected by blower. There will usually be considerable fine dust that is not collected by blower; this should be removed twice a day. Refuse and trimmings must be removed by hand and taken in trucks to boiler room, where they should either be burned or else discharged into shavings vault; they should not be allowed to accumulate in front of boilers.

GLUE POTS

are found in many parts of piano factory, being first encountered in mill room. The same rules apply wherever located. There are several very well arranged types in use, being generally either steam, hot water, gas or electric heated. Large kettles are designed to stand on metal legs $1\frac{1}{2}$ to 2 feet above floor, being provided with steam jacket for heating. Where small pots are needed, the table type of heater (water or steam) is often employed. Individual glue pots can then be removed and used where needed. Floor under large glue pots should be covered with sheet metal.

Numerous small glue pots are used at benches; steam pipes used to heat same should be kept well away from woodwork by bushing and supports. Where gas jets are used for heating bench pots, jets must be firmly secured and proper metal guards provided to protect flame. Heating by gas is much more dangerous than steam or hot water. Electric heated glue pots are seldom found in piano factories. This is usually an expensive though safe method of heating.

THE SHAVINGS VAULT

should be constructed of brick or concrete with non-combustible floors, light non-combustible roof, that would readily yield to an explosion, and opening to boiler room (which should be small as possible) protected by a standard, self-closing, vertical, sliding fire door. A very good design has cement floor inclined toward doorway, so that door need only be opened slightly when firing boiler. Doorway should be 10 or 12 feet from furnace doors. Furnace feeder should be provided with hand and automatic dampers. Vault should be protected by automatic sprinklers and live steam jets with controlling valve in boiler room.

Waste and refuse chutes are often used for disposal of sweepings from various floors; they should be of brick and have open-

ings at floors protected by substantial iron or tin covered doors kept closed when not in use, care being taken not to allow an accumulation of refuse on floor around door. They should discharge into a fireproof bin or vault without openings into factory.

CAUL BOXES

vary in size from small boxes (perhaps 12x18x26 inches) to large ones, being, in fact, good sized closets. All should be lined with lock jointed tin, unless of non-combustible construction, and all but the very small ones equipped with sprinklers. Steam pipes are either at side or bottom, and are frequently installed with no provision for cleaning out around same. Wood strips and stock frequently rest on steam pipes. All caul boxes should be frequently and regularly cleaned and heavy wire provided to keep wood away from steam pipes.

SKELETON AND CASE MAKING.

Hazards found here consist of gluing, caul boxes, sandpapering, disposal of refuse, all of which are referred to elsewhere.

VENEERING.

Hazards here are from glue pots, caul boxes (sanding of veneers being hand work). One other hazard is responsible for fires occasionally. When men are sanding veneered pieces any small cracks or bruises that are noticed are filled in with a special shellac, which comes in sticks like sealing wax, and small tools used for filling in wax are heated either over gas flame or small alcohol lamps. When former are used they should be stationary and encased in tin boxing. Small alcohol lamps should not be used, owing to the greater hazard.

STAINING.

Water stains are used almost entirely and present no hazard, being composed of aniline colors and water. Spirit stains are occasionally used in the cheap grade piano. Stains are always applied by brush.

FILLING.

Paste fillers are usually employed. Some manufacturers prepare their own filler. It is composed of boiled linseed oil, silax, japan, aniline colors, and turpentine is used for thinning (sometimes benzine is used). Paste fillers are bought by the keg and thinned with linseed oil and turpentine in quantities as needed. Lampblack is frequently used to darken filler. It should be kept in metal barrel or box. Main supply of linseed oil, japan, turpentine, benzine, alcohol or other inflammable liquids should be kept in an oil house, detached from main plant if possible; if not, then built according to specifications of the National Board of Fire Underwriters for inside oil rooms.

Only small quantities of these inflammable liquids should be

kept in filling room, in tightly covered cans, and space around should be kept neat and clean. Benches where filling is done are often found deeply coated with filler. Frequent cleanings should be given to prevent this. Benches are often more or less covered with piles of loose excelsior, rags, cotton waste or sea-grass, which are used shortly after filling has been applied to wipe off surplus. As filler contains linseed oil and turpentine, these are rendered very susceptible to spontaneous combustion, and great care should be exercised in their disposition. Room is liable to be fairly warm, thereby increasing hazard. Employees should never be permitted to throw oily material on floor, under benches or into corners. Standard metal waste cans should be provided in sufficient numbers and of ample capacity to take care of all such waste. In some factories a barrel of water is kept in room, rags being immediately immersed in same after using and barrel emptied daily. Too much care cannot be observed in looking after the oily refuse, and a careful inspection should be made by foreman of room before leaving at night.

THE VARNISHING HAZARD

in a piano factory is much lighter than in the ordinary furniture factory, on account, first, of the high grade of varnish that is used, almost invariably turpentine and alcohol for solvents (a finely finished case is often the means of selling a piano, and on this account manufacturer pays considerable attention to appearances, even in very low grade pianos), and, second, application is almost invariably by brush, although in the last year a new dipping process has been put into use whereby six entire cases can be dipped at one time, and with the excellent arrangement in use at the one plant using this system, the fire hazard is well cared for, as the varnish tank has been installed in a well cut-off fire-proof room.* Only very small quantities of benzine or naphtha are used. Shellac is ordinarily used only for the unexposed and small parts, such as guides, pedal actions, damper rods, etc., and supply found is therefore small; shellac is also applied by brush.

The main supply of varnishes, oils, turpentine, alcohol, benzine, etc., should always be kept in detached oil house, 30 feet from main buildings, where this is practical, or in cut-off non-combustible oil house, as previously suggested. A moderate supply of varnishes must always be kept in varnishing rooms, so they will be at proper working temperature, to obtain best results. The best method for handling and storing a barrel or more is to employ one of the patent airtight storage tanks, provided with hand pump; this provides easy means of handling and also insures cleanliness. Many manufacturers buy their varnish

* See special report on dipping process at end of this article.

almost entirely in 5 to 20 gallon tin cans. Where this is done only a small supply need be carried in finishing rooms.

The disposition of oily rags must also be carefully attended to here, and an ample supply of standard metal waste cans provided, which shall be emptied daily.

The flowing process is always carried on in a separate room, with a separate supply of varnish for use here. Quantity on hand should be kept as low as possible.

SOUNDING BOARD.

The sawing, gluing, planing and sandpapering hazards all obtain in the earlier stages of sounding board making. When brought to sounding board room, boards are put into the hot closet, a small dry room fitted with light wood racks for supporting boards on edges, and remain here from one to six weeks, temperature of room varying in different factories from 100 to 130 degrees. Room should be metal lined, and all woodwork kept away from steam pipes. As boards require such careful handling, this room is usually kept fairly clean. "Belly-bars" are heated in caul boxes, and glue pots are in constant use here; both of the latter hazards previously referred to. Sounding boards are generally shellacked and varnished on one of the tables in sounding board room. Careful workmanship is necessary, and only small amounts of shellac and varnish will be found here.

IRON PLATE.

In the large majority of factories there is no hazard connected with the iron plate, as the completed plate is merely received, inspected, stored and secured in place. When they are manufactured (and this is very unusual) several additional hazards exist, i. e., ordinary foundry hazards. In the finishing process rust is removed by emery stone rubbing, and after drilling necessary holes plate is rubbed with alcohol (denatured or wood) or turpentine. These volatile substances must receive the same care already referred to. Boiled linseed oil, coloring matters, lead and varnishes are used for priming and finishing; hardening is done in brick ovens, steam heated to about 220 degrees. Plates are either given a coat of bronze or japan. Latter is applied by brush. No dipping hazard.

MACHINE SHOP HAZARD.

The machine shop hazards will only be found in the large establishments, and where found include the ordinary metal working hazards, such as casting, forging, oil storage, oily waste, japanning, lacquering, electroplating, buffing and polishing, all of which should be arranged in manner described in previous articles.

HAZARDS OF VARNISH DIPPING PROCESS.

The following special report on varnish dipping process is by Edward W. Dart:

In varnishing cases of pianos, instead of using the old hand flowing process, Ludwig & Co. now use a dipping process which is confined to the sixth floor of their factory building. The dipping tank (6x6x8 feet) has a total capacity of about thirty-nine barrels, although only thirty-five barrels of varnish are placed in the tank at a time. The varnish contains a small percentage of naphtha to facilitate drying, this percentage being about 1.5 per cent., or of the entire amount of varnish in the tank about one-half a barrel is naphtha. The only thinning done on premises is with pure spirits of turpentine. There is practically no naphtha odor in dipping room and absolutely none in the factory.

The skylight over dipping room is provided with metal louvred sides, and there is at all times a circulation of air to the outside of building.

The tank is constructed of riveted sheet steel, $\frac{3}{8}$ of an inch thick, and rests on two 12 inch "I" beams, which are imbedded in west wall of building and south wall of elevator shaft about 5 feet above level of fifth floor, and tank projects about 18 inches above floor level of sixth floor.

To prevent tank from bulging a heavy channel beam is placed lengthwise around tank.

Tapped into bottom of tank is a 3 inch emergency drain, which extends through the south wall of building and empties into a steel tank (capacity, fifty barrels) which rests on roof of fire-proof oil house in rear adjoining dry kilns. In the emergency drain close to tank is a brass lever valve, which has a 4 foot arm with a 75 pound weight at end of same. The valve is held closed by a chain which extends through sixth floor and is fastened to wall close to ceiling of dipping room. This chain is provided with two fusible links, one at ceiling of fifth floor and one at ceiling of sixth floor.

Dipping room is 12x26 feet in size, and is enclosed in 8 inches of terra cotta and brick, with one opening, 6x7 feet, protected on each side of wall by standard fire doors. The floor is cement on heavy plank flooring, and ceiling is plaster board and cement plaster on metal lath fastened to wood roof. One Monitor skylight, constructed of $\frac{3}{4}$ inch ordinary glass set in metal frame with louvred sides, pierces ceiling.

At north end of tank is a hydraulic lift, which is used in connection with an overhead crane on which stock is hung for dipping.

The process consists of placing unvarnished stock in special carriages which are lifted by crane and run directly over tank,

when hydraulic attachment allows carriage and stock to be gradually lowered into varnish, after which carriage and stock are gradually lifted from varnish, this process requiring about thirty minutes. The carriages are then equipped with wheels and are run into a frame enclosed drying room, which is lined with lock jointed tin in a standard manner. Temperature varies from 105 to 112 degrees. Room is heated by "live" steam, pressure being about 28 pounds. Stock remains in dry room about six hours, and it is usually necessary to dip and dry stock five or six times, according to nature and condition of stock being treated.

When tank is not in use there is a hinged cover constructed of $\frac{7}{8}$ inch matched lumber and covered with lock jointed tin which is locked shut. It would be impossible to make this cover self-closing with balance and counter weights, as a single door would not close over crane. This method of finishing cases is claimed to give as good if not better results than by the old hand method. The varnish is of such consistency that no air bubbles or other imperfections are formed, and the varnish is flowed smoothly over all.

The dipping room is equipped with sprinklers, there being no sprinkler heads directly over tank.

In making tests to find the length of time required for emptying tank, it was found that with tank filled with water about seven minutes were required from the time fusible links were separated.

CELLULOID MANUFACTURE.

A Description of the Processes and the Fire Hazards Attendant Thereto in Celluloid Factories.

*By Charles L. Purdin, Inspector, Commercial Union Assurance
Company.*

Celluloid is the copyrighted name of a product of the Celluloid Company, of Newark, N. J., but the term is generally applied to the material made under other names, such as fiberloid, viscoloid, pyraline, etc., and, broadly speaking, all of these products are made of the same materials and in about the same manner.

It will be more convenient for me to use the term celluloid, and in its broadest sense, meaning it to apply to this product variously named as before stated.

The subject is one that can be considered with profit at this time, particularly by those in our line of business, for celluloid is used in plants today where a few years ago it was never found. In hair brushes—where until a short time ago only ivory or enameled cement was used for the backing of bristles—sheet celluloid is now found. The old ivory rings used to decorate horse harness have been replaced by celluloid. Amber is now closely imitated and can be made clear or clouded as desired, so that it is difficult to distinguish between real amber and the celluloid imitation. Imitation tortoise shell combs and other ornaments are made by the thousands in celluloid factories throughout the country. All of these articles find their way into our stores, where their handling is frequently far more hazardous than in the factory, because of lack of knowledge as to the danger in the material.

COMPOSITION OF CELLULOID.

Celluloid is composed of the following: An acid mixture (largely nitric and sulphuric acids), cotton or tissue paper, camphor and alcohol. Dry colors are added according to the shade desired. The acids are usually prepared at the chemical works and not mixed at the celluloid plant.

Tissue paper is received in the original roll, and under a revolving knife is cut into small pieces, picked up by a blower system and forced through pipes to a drying room, where it re-

mains for from fifteen to twenty-four hours at a temperature of about 75°. The drying process is intended to take all moisture from the paper, inasmuch as any water remaining would tend to reduce the strength of the acids, which are next introduced. The dry room is a common hazard, and the proper arrangement of steam pipes or hot air systems must be observed and carefully noted by the fire insurance man. After the paper is properly dried it is removed to a room where it is treated with the acids.

PROCESS OF MANUFACTURE.

The thoroughly dried cotton or paper is conveyed from the drying room to the acid department and placed in large jars containing the acid mixture pumped from the storage tanks.

The action of the acid immediately changes the cotton or paper in color from white to a dirty yellowish brown, and from this mass there arises a heavy stifling vapor, which vapor is so corrosive that sprinkler heads in this room must be frequently changed if a sprinkler system is to be depended upon.

The nitrated matter remains there but a few minutes and is then removed to tubs, where a very thorough washing process is commenced. Water is now used in the effort to remove all the remaining or unabsorbed acid. The washing continues for from twelve to twenty hours, and the pulp passes through numerous tubs, in which there is a constant flow of fresh water. It is then placed in a beater, after which it stands in open tanks to allow the water to drain off. Then it is passed on to a "whizzer," where much of the remaining water is forced out.

When the substance is ready for the next treatment there remains no trace or odor of the acids. The pulp is then placed in a hydraulic press, where any water that may be present is pressed out, leaving the nitrated paper pulp in a very hard round cake from 10 to 12 inches in diameter and from 2 to 3 inches thick. These cakes are taken to the breaker room, where under a revolving knife they are cut into very small pieces.

THE CAMPHOR TREATMENT.

The material is then removed to the camphor room, where it is sprinkled with camphor diluted with alcohol. Dry colors are added if any shade other than translucent is desired, and the substance placed on steam heated rollers.

This is one of the danger points, as the raw material will fire by direct heat at 250°. It is necessary, therefore, that the rollers shall be carefully watched. This work is required to thoroughly combine all the properties previously mentioned. It takes from two to three hours to properly roll each sheet.

When the celluloid leaves the hot cylinder rolls it is placed under a press, from which it comes in sheet form about 5 feet long, three feet wide and from 2 to 6 inches thick. It is then cut

into sheets of various thicknesses and placed in a seasoning room, where it remains for at least thirty days.

These seasoning rooms are heated by hot air to temperatures of from 75° to 100°. The temperature is very carefully watched to insure proper curing.

FIRES IN CUTTING ROOMS.

There have been numerous fires in the cutting or breaker room, usually caused by hot bearings or foreign matter in the stock. The operation of this department should be treated similar to that of a picker room in a cotton or a woolen mill, viz., the work should be done in a removed building, and the quantity of stock kept in the building should be reduced to the lowest amount possible.

In one of our largest and most progressive celluloid factories they have succeeded in eliminating this breaker room hazard by the introduction of a separate process. After the paper pulp leaves the "whizzers" in this new process the pulp is weighed and the proper quantity of denatured alcohol is poured over it. It is then put into the hydraulic press. When the compressed matter is removed from the press it is not hard, but very mealy and can be broken by hand. When it reaches the camphor room ground camphor is added dry. The alcohol remaining in the pulp is sufficient in quantity to dissolve the camphor. This change in process will eliminate the breaker hazard.

HAZARD OF SEASONING ROOMS.

Mention has just been made of the seasoning rooms. This necessary feature in the manufacture of celluloid is usually arranged for in detached buildings, and the stock is placed there only to allow the alcohol fumes to depart. With the atmosphere at from 75° to 100° this evaporation is complete in from twenty to thirty days. It is essential that sufficient ventilation be provided to carry off all the chemical fumes, and there must also be an entire absence of any exposed artificial light or flame. It is claimed that any fire at this point would at once cause an explosion. I know of a seasoning building which an employee entered with a lighted pipe. Almost immediately an explosion took place, the man was badly injured and the entire stock valued at over \$15,000 was burned. The roof was carried away by the explosion and the brick walls were shattered. The fire had its lesson for the manufacturers, however, and as a result the newer seasoning buildings are models.

PROPER CONSTRUCTION OF SEASONING ROOMS.

The new buildings are of reinforced concrete, with roof beams of light steel strips, to which are fastened sheets of corrugated asbestos. The roof is provided with a huge iron ventilator. The walls at the sides are about three feet higher than the roof, and

project from 12 to 18 inches beyond the front and rear walls from a point about half of the height of the building. The theory is that in the event of fire and the expected immediate explosion the lightly constructed roof would at once be carried away without other damage to the building.

MANUFACTURING COMBS.

One of the chief products from the manufactured celluloid is the comb. Two methods are followed in making it. In the manufacture of the cheaper article the comb is pressed out under a stamping machine. Little hazard here exists. In another method the teeth are cut by small circular saws, and because of the large amount of dust resulting this has rightly been considered a dangerous work. This sawing may be done under water, each saw operating under an open spigot. A small factory will have a dozen saws operating at one time, and in the larger plants the number will run as high as 400. The wet dust is not dangerous, and owing to the continuous flow of water the dust is constantly removed from the table.

If sawing is done dry—as is sometimes the practice—a blower system is frequently used. The great danger in this practice, however, is that should a spark occur at the machine it is quickly drawn into the pipes and an explosion and fire will result. There is very little waste in the manufacture of celluloid and its products. In the case just mentioned the dust is washed from the tables and carried through pipes to a large tank under ground and outside of the building. At regular intervals the wet dust is removed, taken to another department and the camphor is reclaimed.

MUST ELIMINATE DUST.

The absence of dust in any part of the work is an important feature from a fire insurance standpoint.

Almost all articles must have rough places smoothed down after being pressed or sawed. The buffing wheels on which this work is done are made of cotton cloth, tampico or corn husks. The dust feature is apt to be prominent here, and if possible this work should also be done wet.

To obtain the highly polished surface in celluloid the sheet after being seasoned is placed between nickel plates and heated. Steam tables are used throughout the process in making articles from the finished celluloid. The action of the heat makes the celluloid pliable.

In both of these cases, as well as in the pressroom, the danger lies in any excess of heat in view of the inflammable nature of the stock.

RECENT CELLULOID FIRES.

Concerning celluloid fires of recent occurrence and the story of one instance in which the celluloid was only damaged by fire

and almost at once extinguished by water, the following may be of interest:

In a very large celluloid manufacturing plant in New England, an employee was engaged in cleaning one of the tanks in which the nitrated paper is washed after coming from the acid room. These tanks in some factories are lined with sheet celluloid—this was the case in the present instance. The man had washed the tank and was using a portable incandescent electric light to detect any sediment or dirt that might have remained after the washing. Being called to another part of the building he left the electric bulb, still lighted, on the edge of the tank; in a few seconds there was a flash and the interior of the tank was ablaze. The damage was not great, but it prominently illustrates one fact, which is frequently denied, that "celluloid cannot be made to explode by heat, friction or percussion." In a recent report, after a careful examination by an insurance laboratory committee, they say: "At least 50 per cent. of samples of celluloid of all grades and classes, transparent and opaque, if gradually heated from 310° to 350° Fahr., will explode with flame and considerable energy."

After the celluloid has been properly seasoned, and before it is worked up into various articles, the "blanks" are stamped out. These blanks are laid on steam tables, the action of the heat making the material pliable. At this point in a celluloid comb factory a short time ago sheet celluloid ignited on a tray at the comb stamping machine. The stock had been heated on the softening table and stamped in tooth machine and laid in piles on a tray, when suddenly the stock took fire. This fire was attributed to overheating of the stock, and it is claimed that such fires occasionally happen in risks of this class.

In another recent fire in a celluloid manufacturing plant the cause is attributed to foreign substance in the stock, the fire occurring under the knife in the breaker room, where, you will doubtless recall, the hard cake is placed after coming from the hydraulic press, and where under a rapidly revolving knife the compressed nitrated pulp is cut into small pieces. To illustrate the danger that is anticipated at this point I might state that in one plant I have seen a cluster of sprinkler heads, five in number, placed not more than 18 inches over this knife, and in addition to that precaution there is at about one foot and a half above the sprinkler heads a large iron shield to protect the upper part of the room.

In another large plant it seems that they were in the habit of piling large quantities of the finely cut nitrated pulp on the floor of the mixing room. At the time of this fire it is reported that there were from 6,000 to 6,500 pounds of this material piled in the room. It is stated that there was a sudden flash, almost immediately followed by a heavy explosion which

lifted the roof from the building, and consequently destroyed the sprinkler equipment in the room. The reasons given for this fire are various. One theory is that the pile of nitrated pulp had been placed in front of a hot air duct, and that heat passing through the unclosed duct allowed the hot air to blow onto the pulp. Another claim is that particles of the ground nitrated pulp had gradually worked under the baseboard around the edges of the wooden floor, and that the chemical action of these particles and the decayed wood caused the fire and the resultant explosion.

At Leominster, Mass., a short time ago an interesting fire occurred in which water promptly extinguished the fire that had reached trays of finished combs. The building was a frame structure, the first floor of which was used for mercantile purposes, the upper parts variously occupied by small manufacturing concerns. On the ground floor in one of the stores a tailor had been using naphtha or gasoline in the window of his shop and in some way the liquid caught fire; the flame immediately cracked and broke the window glass and ran up the front of the building. Standing on the window sills of the second floor (the upper windows were opened) were trays of combs; the flame from below immediately set fire to this stock, but a sprinkler head over the window opened and extinguished the flames. The backs of the combs were blistered and charred. I believe, however, that this is a very unusual experience.

THE AUTOMOBILE AS A FIRE HAZARD.

Detailed Description of Its Construction, Equipment and Operation, with Suggestions for Introducing Safety Devices.

By N. B. Pope.

That part of the old scandal that suggested a tendency to go to pieces, like the deacon's "one-hoss shay," has been successfully disproved, but there are a few timorous souls who still believe that the average automobile is liable to blow up most any time. In this connection it is unfortunate that such things do happen occasionally under certain aggravated conditions, and this circumstance, coupled with the fact that wherever cars are garaged it is necessary to store and handle considerable quantities of gasoline, oils and other inflammable materials, lends a certain serious aspect to the matter. That there is a certain amount of fire risk attendant upon the storage and operation of cars is a fact that most automobile men, accustomed to taking proper precautions, are perhaps too much inclined to make light of. Such risk as there is may be said to be increasing, not in the sense that greater menace is involved in the modern car, but in the sense that the number of cars in use is increasing and that each year the number of heedless, incompetent and unscientific operators is increasing. By reason of the fact that it uses a highly inflammable form of liquid fuel, the gasoline automobile commonly is saddled with a greater nominal risk than is rightfully its own. To remove this impression would be a profitable undertaking in many ways; it would strengthen the confidence of the public in the motor vehicle; it would be of material benefit in convincing the manufacturer and merchant of the advantages of motor transportation as an adjunct to his business, and it would tend to avoid and eliminate unjust discrimination between this and other transportation mediums.

So far the question does not appear to concern the automobile engineer in the least, but a moment's reflection will show that he is concerned. He is obviously responsible for the original construction of the automobile, and if it is possible in

any way to alter or amend its properties so as to render it less liable to originate fires than it is at present, or less a menace when contained in a burning building than it now is, it would seem that it is not only a matter of concern, but of duty for him to give the problem due attention. As to the operation of existing vehicles, it is a point not yet generally appreciated that in the broad field of maintenance, as in manufacture, there is ample opportunity for the employment of engineering talent. There is need for the analytical ability and knowledge of the trained engineer in the design and construction of garages and garage appliances, in the development of garage systems, the installation of equipments and the supervision of operations. This is true of the housing and maintenance of pleasure vehicles, but where the commercial vehicle is involved the engineer becomes indispensable. The protection of garages and operating equipments against fire losses thus becomes a very worthy problem for the engineer to consider. Already a great deal has been accomplished in this connection. The average modern, well-equipped garage is so constructed, arranged and outfitted as to be as safe, relatively speaking, as could be desired. Unfortunately this is not true of the average garage the country round. Many such establishments have been converted from other uses, many have been built hastily and without due regard to certain definite precautions that should be embodied in every garage that may properly be called safe. With such establishments the engineer who is in any way in touch with installation and operation work well may concern himself. It is unquestionable that many of them are positively dangerous, not only as pecuniary risks, but in material degree as a menace to the reputation of the industry.

THE PRINCIPLES OF SAFETY IN GARAGE CONSTRUCTION.

are so well known that they need only to be touched upon very lightly in this connection. They include the imperative need of fireproof building construction, constant and effective ventilation of all floors, thorough drainage embodying well-ventilated settling chambers to prevent the accumulation of volatile oils and inflammable supplies, underground fuel tanks and, wherever possible, provision for dispensing fuel and oils in the open air or at least in an isolated court or passage which is subject to thorough ventilation at or about the ground line. In many localities most of these requirements already are taken care of by municipal or insurance regulations. But where the engineer is concerned with getting a certain amount of work out of an equipment at a minimum cost it behooves him to see that no fire loss is involved. In too many instances overmuch dependence is placed on rules and regulations in connection with the care and handling of cars. But rules are the weakest sort of safeguard

imaginable, because they depend entirely on the human equation. The garage risk is twofold. It involves the possible risk arising from the storage and handling of large quantities of oil. It also involves a certain amount of risk due to the housing of a large or small number of cars, each of which may be considered in itself a risk. In an ill-ventilated garage a spark from the unprotected controller of an electric car, the arcing of a switch at a charging board, a stray spark from the ignition system of a gasoline car, a back-fire or a muffler explosion may cause a fire through the ignition of stagnant gasoline vapor or gas. Likewise there is a very

SLIGHT POSSIBILITY OF FIRE IN THE WOODWORK

of an electric vehicle, due to some derangement of circuits, while the gasoline car presents certain very lively possibilities in this direction. Not only may cars of this type become the source of fires, but their tank-loads of fuel become, in the minds of the public and of firemen who may be called upon to handle a blaze, so many charged bombs ready to scatter burning gasoline in every direction. That in many known instances cars have been badly scorched and even partially burned without sufficient pressure being generated in their tanks to cause them to burst is a peculiar circumstance that, while comforting in itself, it is not to be depended on as a precedent. It is my desire particularly to call attention to the fact that the very circumstance that every motor vehicle carries a certain amount of stored energy in itself constitutes what may be termed a potential risk and to emphasize the importance of safeguarding the public and the industry against future losses from this source. Considering the exact nature of the hazard—that is to say, the number of cars in use today, which has been placed at not far from 400,000 in this country, and the amount of energy which they daily consume—it is a high compliment to the industry that the actual risk is no greater than it is. It is unquestionable, however, that whatever risk exists today can be materially reduced in the individual machine by careful forethought and design in the assemblage. Scrutinized in detail, probably the average car of modern construction would seem at first to be as safe as it can be made; doubtless this would be true were it always to be handled in a careful manner. Unfortunately, however, the average driver is to be considered in all his moods and in every state of mind and body in which he may undertake to handle the machine. The pleasure car is subject to the abuse of thoughtless, reckless, and often of intoxicated operators; the commercial car is destined to be cared for by men of more cautious temperament, as a rule, but less alert and intelligent. Neither type of machine can be overlooked in attempting to reduce to a minimum the fire risk. Incidentally, a factor that must be considered in

connection with the latter type is that not only the vehicle itself, but its load of merchandise as well, is involved in any risk of which the vehicle partakes. Therefore, the commercial car that is absolutely free from fire risk—and I believe it perfectly practicable to construct one—should prove an attractive proposition to market.

THE PROBLEM OF FIRE RISK

as involving the individual machine may be considered under two general headings: First, the power plant, and, second, the general vehicle structure. Under the first heading electric and gasoline equipments may be discussed independently. Considering, then, the power element of the electric vehicle, it is apparent that there are but two possible sources of risk, namely, the electric spark and the overheated wire. Sparks may occur at the controller, at the motor or from crossed wires or short-circuits caused by disarrangement of the wiring or connection. The liability of burn-outs, either in the motor or in the connection is small, though burned-out motors are by no means unknown to electric vehicle history. Equally simple are the protective measures that are available. All controller and motor mechanisms should be iron-clad and the controller, at least, asbestos-lagged if its construction is such as to render it at all liable to arcing at the contacts. All conductors, whether on battery, motor or bell and lighting circuits, should be thoroughly protected against chafing and disarrangement and all outside connections should be protected in suitable junction boxes. While both the iron-clad method of arrangement and the use of lead-sheathed conductors are expensive, the permanence of either alternative, combined with the immunity from injury which it issues to the conductors, should sanction the use of one or the other on all carefully constructed cars. For motor connections lead-sheathed flexible conductors are preferable to the more common circular-loom protection.

IN THE CASE OF THE GASOLINE MACHINE

the risk is more involved, first, because the power plant itself contains greater elements of danger, and, second, because the presence of considerable quantities of gasoline and oil increases the liability of a fire spreading regardless of its origin. The gasoline car risk may be divided into primary and secondary elements. Considered in order the elements of direct risk are: 1. Fuel tank. 2. Fuel piping. 3. Carburetor. 4. Exhaust piping and muffler. Any one of these elements may become a direct hazard as a result of poor construction, careless handling and accident. Secondary elements of risk, or those which in conjunction with one or more of the direct elements may lead to a fire in the car itself, are: 1. Ignition system. 2. General arrangement.

Just as "crossed wires" are blamed for a majority of buildings' fires of otherwise unexplained origin, so "explosion of gasoline" is the cause assigned to most automobile fires. But the automobile engineer must seek further in order to arrive at a proper means of preventing loss. In the first place, gasoline, in the ordinary acceptance of the word, does not explode. Indeed, those who have become thoroughly familiar with its properties through carburetor experiments know that even its vapor is reluctant to ignite save under the most propitious circumstances. Therefore, the chief danger in connection with the gasoline tank and piping is leakage, as this is the principal cause of trouble where fuel tankage and piping are involved in a fire. As a means of preventing leaks the tank must be of such strength and so mounted that it will not be strained by the working of the car, while the piping should be so arranged that it will yield to frame distortion without injury to the couplings. These precautions already are taken satisfactorily in most cars, though it is impossible that the use of copper or tin-lined steel tanks of sufficient strength to resist considerable internal pressure would inspire confidence in the safety of the car with respect to the danger of the bursting of the tank in the event of a fire. There is no question that the air inlet to gravity tanks should be protected by a gauze screen as a means of preventing the ignition of the free gas within the tank, while pressure tanks might be provided with a blow-out plug mounted over a screened orifice as a means of preventing an explosion and providing an outlet for the fuel vapor during a fire.

AS A SPECIAL MEANS OF PRECAUTION

it is possible to conceive of an emergency shut-off for the carburetor feed pipe, spring actuated and ordinarily held open by a plug of fusible metal. Such an arrangement could be so constructed that it would close the gasoline line automatically should the contents of the carburetor take fire. With suitable measures to prevent carburetor fires, however, this would seem uncalled for. But it is particularly important that the regular gasoline shut-off from the tank be so located that it may be reached in an emergency without difficulty or delay, and, furthermore, that it be so conspicuously arranged that it can be manipulated by one not otherwise familiar with the mechanism of the car—even at some risk of unlicensed tampering. The average carburetor may be innocent enough of any menace in the way of setting fire to the machine, but it is well known that it lies well within the means of the average motorist to produce a mixture that will back-fire, and back-fires occasionally furnish heat enough to vaporize the contents of the float chamber. As gauze screens not only will prevent the passage of flame beyond a given point, but, in the opinion of many engineers, are helpful in carrying out

the atomizing of the charge and the dissemination of heat through it, it is difficult to see why the average carburetor is not provided with screens already.

Certainly designers who object to obstructing intake pipes with wire mesh should have no compunctions about screening the outer air passages, and such screens would prevent the issuance of flame even were the contents of the mixing chamber to take fire, at least until the flames could be put out either by racing the engine or shutting off the air. Combined with the occasional tendency to back-fire, probably the greatest source of danger in the average carburetor is leakage arising from improper adjustment. As this cannot be forestalled by the designer, the only thing left for him to do is to provide a separate drip for the carburetor outside the sod pan. The importance of making this provision cannot be too strongly emphasized and it can be asserted confidently that this simple precaution, coupled with the arrangement of all gasoline feed piping outside the pan, will do more to avoid loss in individual fires than almost any other step that can be taken in the drafting room. The exhaust side of the motor is commonly regarded as being free from danger in respect to fires, but it is not absolutely so. Improperly made joints and gaskets, blown out by explosions in the exhaust manifold and piping, are liable to cause the ignition of any stray vapors, as may the bursting of the muffler. Therefore, it is important that provision be made for tight joints and amply strong construction.

THE IGNITION SYSTEM

has been mentioned as a secondary element of risk. It becomes so only when so constituted that a stray spark at the timer may serve to ignite inflammable vapors which may have collected under an improperly ventilated hood. Under the broad head of general construction may be considered, first, the arrangement of the motor with respect to inflammable material; second, the question of lubrication as a contributory cause, and third, ventilation. Commonly speaking, there is little fault to be found with the mounting of the engine in regard to the proximity of woodwork. But it is possible to find many instances in which too little attention has been paid to the risk that is involved in this way. Oil-soaked and blistered dashes and floor boards are by no means uncommon, and while the writer does not know of a single instance in which a fire has been started from an overheated exhaust pipe, the readiness with which such conditions would lend themselves to a fire once started may be held to explain the rapid consumption of some cars that have been burned to the ground in a very few minutes. Plainly it is important to employ metal construction for the engine compartment, particularly where the motor is housed under the seat or beneath the floor boards, as in some of the lighter forms of commercial vehicle, and to be liberal

in the use of asbestos-lagging where it is necessary to bring hot metal close to dry wood. As far as lubrication is concerned it may be considered that the presence of waste oil in the sod pan, on the outside of the cylinders and crank case and on the interior of the engine compartment, adds to the risk, though not tending to incite conflagration. The modern forms of self-contained engine oiling system are models in this respect, and it may be assumed that as time goes on general cleanliness about the engine will increase. It is important that in laying out a power plant there shall be no unventilated pockets where oil or gasoline can collect to contribute to the risk. Turning from the power plant to the

GENERAL CONSTRUCTION

of the vehicle, but more particularly the body, conditions are much the same as in any other medium of transportation. It is possible, for example, to build a perfectly fireproof body; such bodies are now being built on chassis designed for the transportation of money and securities. The all-metal body would not only have its advantages in this respect, but there is much to be said in its favor from the point of view of economy, and it is by no means a rash prediction that it will be commonly, if not generally, adopted in commercial vehicle construction in the not far-distant future. Certainly all body parts which are close to heated metal, or such as might become inflammable if saturated with oil, should be, if not of metal construction, at least metal-sheathed. One other question which arises in this connection is that of illumination. It is commonly considered that no great risk is involved, even in the use of kerosene lamps, and probably the only instance in which the lamps have been in any way concerned with the starting of automobile fires has been in cases where a detached lamp has been used as a searchlight by some short-sighted Diogenes of the car in search of an honest leak. It is beyond question, however, that the more general adoption of electric lighting on cars, even on those of the commercial type, will be of assistance in reducing the nominal risk of fire.

LAUNDRIES.

A Description of the Processes of Laundering, the Attendant Fire Hazards, and Ways and Means of Improving Undesirable Conditions as Frequently Found in This Class of Risk.

*By John M. Boylan, Inspector, With J. Lehrenkrauss' Sons,
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Homer is strangely silent on the laundries of old Troy, although the Wooden Horse was undoubtedly the original unprotected dry room. The modern Odyssey might well describe the wanderings of Ulysses in search of a real hand laundry, for, if present-day Troy has its way, the only part the hand will play in the laundries of to-morrow, will be in feeding the very human-like machinery that the city on the east bank of the Hudson is turning out.

The laundry as a fire hazard must be reckoned with in a great variety of risks, from the humble home through the palatial mansion, large apartment house, public and private institution and hotel, to the commercial laundry of modern or ancient equipment. The costly residence and its fine appointments may often be at the mercy of the unguarded hazards of its laundry, and the lives of hundreds in hotels and institutions may be endangered by a laundry primitive as to its fire safeguards.

For the purpose of this article, let us consider the every-day commercial laundry. The construction will run from the poorest wood frame through the ordinary brick store-and-dwelling type and ordinary factory or loft building (often of "compound" occupancy) to the plant of superior construction and thoroughly sprinklered, and with outside cut-off power plant. This last type is found not infrequently rising Phoenix-like from the ashes of a

CONSTRUCTION OF THE COMMERCIAL LAUNDRY.

worn out plant on which the stock companies paid a heavy loss—the modern well equipped and thoroughly protected plant on completion going to the mutuals.

DANGERS FROM STEAM BOILERS.

Steam is a factor of prime importance in most laundries—no matter what the motive power—and in few other risks will more

flagrant disregard of the hazards of the use of steam be found than in the laundry. In the large cities many laundries set up operations in an ordinary store-and-dwelling building. A high pressure boiler will frequently be installed in the cellar under a poorly protected ceiling or the floor may be cut away above it in case the boiler be of the upright type. In either event the flue pipe will run into the four-inch house chimney or up through the floor so close to a furred wall as to be unsafe, and thence out through the wall or a convenient window and up the outside wall and above the roof. One ambitious proprietor who had several small laundries hired the grade floor and basement of an ordinary store-and-dwelling building with wall finish of plaster on wood furring. He put his boiler inside in the basement and ran his metal flue pipe up through the floor within a few inches of the furred wall to a point just under the first floor ceiling, where it entered the four-inch house chimney. The danger of this arrangement was pointed out to the proprietor, but he claimed it was the best he could do, as the city ordinances would not permit him to run the flue up through the sidewalk and he was not in a position to build a suitable chimney. About a month after he started operations the inevitable happened and the fire put the plant out of business. At the time of writing a plant is being fitted up in a loft building of the poorest construction, and the boiler is being set up with but 15 inches clearance under a light board ceiling, and the condition of the building is such that the writer is strongly of the opinion that within a short time after operations are commenced the building will collapse—if it does not first take fire. There appears to be no doubt of the ultimate occurrence of either contingency—and very likely both.

A MORAL HAZARD.

The most modern laundry machinery had been installed in both instances above cited. This is a feature worthy of note, as it appears manufacturers can be induced to install the most modern laundry equipment on a small cash payment, taking a chattel mortgage for the unpaid balance. The result is that many concerns with little actual cash backing are embarking in this business, and being able only to hire space in the cheapest kind of buildings, which are poorly adapted to their needs, conditions develop similar to those cited. Sharp as may be the competition for business in their line, the manufacturers apparently find that it is also keen among fire insurance companies, and, evidently being able to protect their chattel mortgage interest by insurance, do not consider it necessary to worry about the conditions surrounding their fine machinery.

PROCESS—WASHING.

The first or washing process presents no serious hazards other than those common to machinery—i. e., belt friction, hot bear-

ings, oily machine waste, etc. Drying here is mostly accomplished by wringing and in centrifugal extractors, and is known as "rough dry," which completes the processes in the wet-wash laundries—goods being returned to patrons in the "rough dry" state. Starching, drying and ironing processes follow in order.

STARCHING.

The starching is only worthy of note as to method of heating and arrangement; there are now steam starch cookers and a patented starching machine which seems to be an addition to the horrors through which the shirt or collar must pass in its travels through the modern laundry. No serious hazard is here presented.

DRY ROOMS.

The dry rooms are an important feature both to the laundry and the fire insurance interests. Invariably the dry room is a wooden box, or a series of them, in which heat is steadily maintained at a high temperature. Coal and gas stoves will still be occasionally found furnishing the heat—the "heathen Chinee" not being alone in this regard—but steam is the more popular medium.

The protection to walls, floors and ceiling will vary from none whatever in the poorest types to lock jointed tin in the best, with various modes of protection in the intervening classes. Right here the writer ventures to raise a still small voice in protest against the all metal method of protection from constant heat. Considering that the metals in vogue retain as well as radiate heat, it would seem to be good practice to have a layer of good asbestos or other non-conducting material between the metal and the wood in all places where heat is constant. Steam heat dry rooms without protection, or with only partial protection, and which have been in use for some time, would be well worth the careful study of those who are in doubt as to the fire hazards of steam heat.

The newer fashions in dry rooms turned out by the Troy machinery tailors leave little to be desired. Three varieties may be mentioned: First—the all metal sectional dry room with horizontal galvanized iron clothes racks attached to door of each section which slides in or out of the dry room as required. Steam coils on all metal racks are arranged between the sections, and while it is still possible for articles to lodge on the pipes it is not so liable to happen as where the coils are at the bottom of the dry room. It would seem that this upright arrangement of pipes might be so boxed in metal as to obviate even this possibility without an appreciable loss of heat.

The second variety is the wood dry box with all exposed parts covered with lock jointed tin, but otherwise arranged similarly to that above described. The third or traveling dryer is like in

construction to either of the first two, but has also a traveling chain arrangement with metal hooks, on which the goods are hung at one end of the dryer to emerge completely dried at the other. The steam pipes here will be found on metal racks around three sides of the room or in the centre, and the speed of the traveling mechanism is so gauged that, at the heat maintained, an article will be completely dried in the length of time required to travel from one end of the device to the other. In all three varieties of dry rooms fans in the ceiling of the room tend to circulate and evenly distribute the heat.

IRONING PROCESSES AND MACHINERY.

Mangles and ironing machines with iron rolls, which are usually heated by gas or steam, have muslin and linen wrappings, the scorching and ignition of which are hazards to be considered. Watchfulness, and frequent replacing of wrappings are necessary, and also care as to the gas flames, to prevent ignition of inflammable material. "Art" edge ironers, seam ironers and turn-down collar "molding" or finishing machines are a few of the newer small devices, bright in nickel trappings and heated by gas or steam, or both. In quite a number of laundries, the old sad iron is still used for certain grades of work, and in certain types it is the only method of ironing. The irons are heated on coal or gas stoves, and these, as well as the gas and electric irons, present the hazard of being carelessly left standing on inflammable material. There is the further hazard in the case of gas irons of failure to turn off the cock when not in use. Right here it may be remarked that underpaid and overworked help are a hazard to be seriously considered in many laundries, commercial and otherwise.

GAS TUBING.

Rubber gas tubes will be found on many of the machines as well as the gas stoves, and, despite the opinion of many proprietors, most if not all of these can be replaced by rigid metal pipes. The writer has in mind an instance where, at the suggestion of the inspector, the engineer of the plant was appealed to by the proprietor as to the feasibility of replacing the rubber tubes by metal pipes. His reply was that it was not alone feasible, but desirable from an economic standpoint. The result was the prompt replacement by rigid metal pipes of all the rubber gas tubes in that laundry with a consequent reduction in the rate.

AS TO PROTECTION,

in non-sprinklered risks, where the water supply will warrant, high test sprinkler heads properly piped may be installed in dry rooms and afford good service. In all laundries a good supply of filled water pails can be and should be maintained with

regular inspection. In the writer's opinion, standpipe and hose equipment are of little service in most risks, and particularly so in laundries, where hysteria is to be reckoned with in any excitement. One or two cool heads might better employ the time usually wasted in getting the equipment into service—even admitting the hose did not fall apart or burst when used—in turning in an alarm and directing a bucket brigade.

Many losses have been paid on laundries, and on other risks, because of laundry hazards, and many more will be paid. A little intelligence properly displayed might have prevented many of the fires, and a little intelligence in the selection of risks undoubtedly would have saved many of the companies from losses, and would have resulted in a fairly good average on laundry risks as a class. The condition and maintenance of not a few laundries would lead the casual observer to believe that it would be impossible for such risks to obtain insurance, but this is not the case. The stock companies will continue to pay losses on the worn out, run down risks, often to see their money go toward the construction and equipment of high class risks, which are at once insured in the mutuals.

THE MORAL HAZARD.

Laundry risks as a class are steadily improving, and this article would serve no good purpose if it failed to point out that fact as well as that selection is more than ever necessary if a good showing is to be made on the class. For, by very reason of the many new plants, modern in construction and equipment, the old, poorly equipped and badly maintained plants are being outstripped in the race for business, and consequently, by reason of physical and other conditions, are becoming less desirable from an insurance standpoint.

FORMS; FROM THE COMPANY'S STANDPOINT.

Able Presentation of the Company's View of One of the Most Important Parts of Fire Insurance Work.

(By William N. Bament, Chief Adjuster for the Home Insurance
Company of New York.)

The subject of insurance forms is such an exceedingly broad one, that it will be impossible in an address such as this to do more than touch upon it in a general way, and direct attention to some of the more important forms, which, although in general use, may possess features which are not fully understood.

The best form, whether viewed from the standpoint of the insurance company or the insured, is a fair form, one which expresses in clear, unambiguous language the mutual intention of the parties, and affords no cause for surprise on the part of either, after a loss has occurred. But the preparation of such a form is not always an easy task, and it is right at this point that the ability of the broker and the underwriter come into play.

A distinguished Englishman declared that the English Constitution was the greatest production that had ever been conceived by the brain of man, but it was subjected to the most scathing criticism and violent assaults by Bentham, the great subversive critic of English law. Twenty-five years ago the New York Standard Policy was prepared by the best legal and lay talent in the insurance world, and the greatest care was taken to present not only a reasonable and fair form of contract between the insurer and the insured, but one which could be easily read and understood.

While no such extravagant claims have been made for the Standard Policy as were made for the "Matchless Constitution," it has for a quarter of a century stood the test of criticism fully as well, if not better than its most ardent friends could have reasonably expected, yet some of its more important provisions have frequently been before the courts for construction, and the various tribunals have differed radically in their decisions.

A perfect constitution and a perfect policy may therefore be safely placed in the list of things unattainable, but if there is any one who can make a nearer approach to perfection in the art

of constructing a written form which will result in a maximum of loss collection with a minimum of co-insurance or other resistance than a present day broker, he has not yet been discovered.

TENDENCY TO BECOME COMPLEX.

The ornate policies in use thirty years ago, with no uniformity in conditions, with their classification of hazards which no one could understand and their fine print which few could read have given way to plainly printed uniform Standard Policies with materially simplified conditions. But the written portion of the insurance contract, owing to our commercial and industrial growth, instead of becoming more simple has taken exactly the opposite direction and we now have covering under a single policy or set of policies, the entire property of a coal and mining company, the breweries, public service or traction lines of a whole city and the fixed property, rolling stock and common carrier liability of an entire railroad system involving millions of dollars and containing items numbering into the thousands. This forcibly illustrates the evolution of the policy form since the issue of the first fire insurance contract by an American company 160 years ago, in the familiar name of John Smith, covering "£500 on his dwelling house on the east side of King street, between Mulberry and Sasafras, 30 feet front, 40 feet deep, brick, 9 inch party walls, three stories in height, plastered partitions, open newel bracket stairs, pent houses with board ceilings, garrets finished, three stories, painted brick kitchen, two stories in height, 15 feet 9 inches front, 19 feet 6 inches deep, dresser, shelves, wainscot closet fronts, shingling 1-5 worn."

It will be observed that in the matter of verbiage this primitive form rivals some of our present day household furniture forms and all will agree that unless there were other members of Smith family by the name of John owning property in that immediate vicinity in Philadelphia, this particular dwelling might have been covered just as effectually and identified quite as easily without such an elaborate description.

Any one who has an insurable interest in property should be permitted to have any form of contract that he is willing to pay for, provided it is not contrary to law or against public policy, and judging from a contract of insurance issued by a certain office not long ago the insuring public apparently has no difficulty in securing any kind of a policy it may desire at any price it may be willing to pay. The contract in question was one for £20,000, covering stock against loss from any cause, except theft on the part of employees, anywhere in the Western Hemisphere on land or water without any conditions, restrictions or limitations whatsoever, written at less than one half the exchange rate in the insured's place of business. An insurance agent upon being asked whether he thought it was good, said

that if the company was anywhere near as good as the form, it was all that could be desired, but vouchsafed the opinion that it looked altogether too good to be good.

In these days we frequently find concentrated within the walls of a single structure one set of fire insurance policies covering on building, another on leasehold interest, another on rents or rental value—and in addition to this policies for various tenants covering stock, fixtures, improvements, profits and use and occupancy, subject to the 100 per cent. average clause, to say nothing of steam boiler, casualty and liability insurance, thereby entirely eliminating the element of personal risk on the part of the owners and producing a situation which will account in some measure for the 17,000 annual fire alarms and \$15,000,000 fire loss in New York City, \$230,000,000 annual fire loss in the country at large and for the constantly increasing percentage of cases where there are two or more fires in the same building and two or more claims from the same claimant.

The most common and perhaps least understood phrase found in policies of fire insurance is what is known as

THE "COMMISSION CLAUSE,"

which reads "his own or held by him in trust or on commission or sold but not delivered" or "removed." This clause in one form or another has been in use for many years. and it was originally the impression of underwriters that owing to the personal nature of the insurance contract a policy thus worded would simply cover the property of the insured and his interest in the property of others such as advances and storage charges, but the courts have disabused their minds of any such narrow interpretation and have placed such a liberal construction upon the words "held in trust" that they may be justly regarded as among the broadest in the insurance language and scarcely less comprehensive than the familiar term "For account of whom it may concern"; in fact the principles controlling one phrase are similar to those governing the other.

It has been held that whether a merchant or warehouseman has assumed responsibility, or agreed to keep the property insured, or whether he is legally liable or not, if his policies contain the words "held in trust" the owner may, after a fire, by merely ratifying the insurance of the warehouseman, appropriate that for which he paid nothing whatever and may file proofs and bring suit in his own name against the warehouseman's insurers. Nor is this all, for in some jurisdictions if the warehouseman refuses to include the loss on property of the consignor in his claim against his insurers he becomes liable for damages to the extent of said loss, or if he does include it and the amount of insurance collectible is less than the total loss, the warehouseman may not first reimburse himself for the loss on his own goods

and hold the balance in trust for the owners, but must prorate the amount actually collected with those owners who may have adopted the insurance; although, if he has a lien on any of the goods for charges or advances this may be deducted from the proportion of insurance money due such owners.

The phrase

"FOR ACCOUNT OF WHOM IT MAY CONCERN"

was formerly confined almost entirely to marine insurance, but in recent years there has been an increasing tendency to introduce it into policies of fire insurance.

All authorities are agreed that the interests protected by a policy containing these words must be restricted to those within the contemplation of him who took out the policy at the time it was issued. It is not necessary that he should have intended it for the benefit of some then known and particular individuals, but it would include such classes of persons as were intended to be included and who these were may be shown by parol. The owners or others intended to be covered may ratify the insurance after a loss and take the benefit of it though ignorant of its existence at the time of the issuance of the policy, just the same as under the term "held in trust."

The words "for account of whom it may concern" are not limited in their protection to those persons who were concerned at the time the insurance was taken out, but will protect those having an insurable interest and who were concerned at the time when the loss occurs. They will cover the interest of a subsequent purchaser of a part or the whole of the property and supersede the alienation clause of the policy (*U. S. S. C., Hagan and Martin vs. Scottish Union and National Ins. Co., 32 Ins. Law Journal, p. 47*).

A contract of insurance written in the name of "John Doe & Co. for account of whom it may concern" should contain a clause reading "loss, if any to be adjusted with and payable to John Doe & Co.," not "loss if any payable to them" or "loss if any payable to the assured"—as forms sometimes read.

Policies are frequently written in the name of a bailee covering "on merchandise, his own and on the property of others for which he is responsible" or "for which he may be liable"—and it has been held that the effect of these words is to limit the liability of the insurer to the loss on the assured's own goods and to his legal liability for loss on goods belonging to others. But the words "for which they are or may be liable" have been passed upon by the Supreme Court of Illinois and they have been given an entirely different interpretation. That tribunal in the case of *Home Insurance Company vs. Peoria and Pekin Union Railway Company* (28 Insurance Law Journal, page 289), decided that the words quoted were merely descriptive of the cars to be in-

sured; that the word "liable" as used in the policy did not signify a perfected or fixed legal liability but rather a condition out of which a legal liability might arise.

As illustrative of its position the court said that an assignor of a negotiable note may, with no incorrectness of speech, be said to be liable upon his assignment; but his obligation is not an absolute fixed legal liability but is contingent upon the financial condition of the maker, and accordingly held that the insurance company was liable for loss on all the cars in the possession of the railroad company notwithstanding the fact that the latter was not legally liable to the owners.

In view of the exceedingly broad construction which the courts have placed upon the time honored and familiar phrases to which reference has been made, it is important for the party insured, whether it be a railroad or other transportation company, a warehouseman, a laundryman, a tailor, a commission merchant or other bailee to determine before the fire whether he desires the insurance to be so broad in its cover as to embrace not only his own property and interest, but also the property of everybody else which may happen to be in his custody; if so he should be careful to insure for a sufficiently large amount to meet all possible co-insurance conditions, and if he wishes to make sure of being fully reimbursed for his own loss his only safe course is to insure for the full value of all the property in his possession.

SUGGESTION FOR A NEW FORM.

At this point the inquiry which naturally presents itself is, how should a policy be written if a merchant, warehouseman or other bailee desires to protect his own interest but not the interest of any one else. The following form is suggested: "On merchandise his own, and on his interest in and on his legal liability for property held by him in trust or on commission or on joint account with others, or sold but not removed, or on storage or for repairs, while contained, etc." This will, it is believed, limit the operation of co-insurance conditions and at the same time prevent the owners from adopting, appropriating or helping themselves to the bailee's insurance, for which they pay nothing and to which they are not equitably entitled.

The following clause has been suggested for use on policies containing the Commission Clause:

"Loss, if any, to be adjusted with, payable to, and recoverable by John Doe, and John Doe only."

Many of the household furniture forms now in use, in addition to embracing almost every conceivable kind of personal property except that specifically prohibited by the policy conditions, are also made to cover similar property belonging to any member of the family or household, visitors, guests and servants.

This form would seem to indicate considerable ingenuity on

the part of the broker, broad liberality on the part of the insurance company and commendable generosity on the part of the insured, and the latter would probably feel more than compensated by being able to reimburse his guest for any fire damage he might sustain while enjoying his hospitality, but the amount of insurance carried under such a form should anticipate the possibility of having a number of guests at one time and a corresponding increase in the value at risk.

It must be borne in mind that in localities where co-insurance conditions prevail the value of property belonging to all members of the household, guests and servants will be taken into account for co-insurance purposes in event of loss, and as guests frequently have with them wearing apparel and jewelry of considerable value, a situation might easily arise which would result in quite a large part of the loss being uncollectible.

But aside from the element of co-insurance, which is not generally applicable to household furniture risks, the fact remains that under such a form the members of the household, visitors, guests and servants, are insured quite as effectually as the party specifically named as the "insured" in the policy and by merely adopting the insurance which has been generously provided for them they will have just as much right to the proceeds, to the extent of their interest, as the nominal insured, for a policy so written is controlled by the same principles as those governing property held in trust or for account of whom it may concern.

If, therefore, the insured does not desire to carry insurance for an amount sufficiently large to meet these possible contingencies, he should content himself with a less ambitious form of policy, otherwise he may under certain conditions find himself the victim of his own generosity.

In the absence of co-insurance conditions, this broad, all inclusive form need not give the average householder any special concern, for it is highly improbable that a guest at a private residence would presume, uninvited, to avail himself of his host's insurance, although servants and members of a household who are not members of the family might not be so considerate.

It is, however, an exceedingly dangerous form for use in policies covering the contents of *quasi* public institutions, hotels and boarding houses, for it is hardly conceivable that the managers or proprietors would desire to carry and pay premium on insurance sufficient to cover the uncertain and constantly changing values of the property of their guests, especially when they are under no obligation so to do.

The question is frequently asked whether goods in bond should be insured for the value with or without the inclusion of customs duties or internal revenue tax; also, whether the policy form should affirmatively include or exclude the duty or tax or make no mention of it whatever.

According to the internal revenue laws (Sections 3221 and 3223), when any distilled spirits in bond are destroyed by accidental fire or other casualty, without any fraud, collusion or negligence of the owner thereof, no tax shall be collected on such spirits so destroyed, or, if collected, it shall be refunded upon the production of satisfactory proof that the spirits were destroyed as specified in the statute. But when the owners may be indemnified against such tax by a valid claim of insurance, for a sum greater than the actual value of the distilled spirits, before and without the tax being paid, the tax shall not be remitted to the extent of such insurance. In short, the insurance would be regarded as covering the tax to that extent, and the insurance companies would have no subrogation rights. As virtually all losses on spirits in bond occur without negligence on the part of the owner, and as the statute makes the refund or cancellation of the bond mandatory, there would seem to be no necessity whatever for insuring the tax and the usual and better practice is to affirmatively exclude it in the policy forms.

AS RESPECTS DUTIES ON IMPORTS,

the situation is somewhat different. According to Section 2984 of the United States Revenue Statutes, the Secretary of the Treasury is "authorized" upon production of satisfactory proof of the actual injury or destruction, in whole or in part, of any merchandise while in bond by accidental fire or other casualty to abate or refund, as the case may be, the amount of import duties paid or accruing thereupon, and likewise to cancel any warehouse bond or bonds in whole or in part, as the case may be.

Although there is no court decision definitely passing upon the question as to whether the above provision is mandatory or whether the matter is left by the statute entirely within the discretion of the Secretary of the Treasury, it has for years been the practice of the Treasury Department to treat it as if it were mandatory, and it is practically certain that the owner of goods in a bonded warehouse would not lose anything on account of duties in event of destruction of the property by fire.

Some very good authorities entertain the opinion that it is not advisable to affirmatively exclude duties from the cover of the policies and that in the absence of special mention of the duties in the form the imported value, without duties, will be the basis of settlement for loss and co-insurance purposes.

All the decisions prior to the enactment of Section 2984, providing for the refund or abatement, were to the effect that as the insured was absolutely liable to pay the duties even though the goods were destroyed his only relief was to look to his insurers, but there does not appear to have been any decision since the enactment of said section as to its effect upon the liability of the insurer.

On the other hand, some good authorities entertain the opinion that if the insurance is sufficient in amount and the duties are not expressly excluded it would be held to cover them, because they become an obligation immediately upon importation and the owner is liable for them until he obtains their remission. In this view of the matter the fact that it is more or less easy to get the duties remitted is immaterial, and it is believed by those who entertain the above opinion that the courts would not allow the insurance company to compel the insured to reduce his claim against it by enforcing his rights against the United States Government.

This might possibly be true if the duties were already paid at the time of the fire or paid subsequently in order to secure the release of the property for salvage purposes, in which event the insurance company would be subrogated to the rights of the insured against the Government. If, however, the property is totally destroyed and the duties remain unpaid it is difficult to perceive how the insured can collect anything beyond the invoice value, for until he actually pays the duties he sustains no loss thereon, even temporarily, and if they are remitted he never will sustain any loss thereon.

The mere fact, however, that there has been no final court decision, and that there are differences of opinion on the subject, emphasizes the advisability of having it definitely stated in the policy form whether the duty it to be considered a part of the value insured or not, and it is also desirable to have it determined before the fire occurs by whom the duty and warehouse charges shall be paid in event of it being necessary to remove the stock from the bonded warehouse to protect it from further damage, or for salvage or other purposes.

The following form, which is used by some companies, would seem to meet the necessities of the situation when it is desired to exclude the duty as a part of the value.

"It is understood and agreed that the Custom House duties payable to the United States Government on property covered by this policy shall not be considered as part of the value insured in event of loss or damage.

"It is also understood and agreed that on demand of this company, in the event of loss, the insured shall, 'to protect the property from further damage,' promptly pay all government duties, warehouse and other charges necessary for the purpose of removal of said merchandise to such other location as may be designated by this company."

In view of the statute providing for remission or abatement and the well settled policy of the Treasury Department in interpreting it there does not appear to be any particular necessity of insuring the duty, and to pay premium on this additional valuation would

be an expense without compensating benefits commensurate with the outlay.

The question as to the proper course to pursue when property is sold under contract is one concerning which there is considerable misapprehension, a great many entertaining the erroneous belief that so long as the legal title remains in the vendor he is the owner of the property and that it should be insured in his name.

It has, however, been quite uniformly held that a vendee in possession under an executory contract of sale, who is in a position to enforce specific performance, is the equitable or real owner of the property. It is vendible as his, chargeable as his, capable of being encumbered as his; it may be devised as his, would descend to his heirs, and while he is living is insurable as his. The vendor who retains the legal title simply has a lien on the property for the unpaid balance due on the contract; the substance of ownership has passed, only the shadow remains. As the vendee under these conditions can insure the property for its full value as his own, it logically follows that the vendor cannot insure it as owner, for it can hardly be maintained that there can be two sole and unconditional owners of the same property at the same time. Therefore a New York Standard Policy which contains a stipulation against change in interest, title or possession becomes void unless properly indorsed, if the property is sold under contract, and the vendee is given possession.

If it is desired to protect the interest of the vendor only, it can be done by issuing the policy in his name, but it is absolutely necessary to state therein that the property has been sold under contract or that a bond has been given for a deed. The only interest the vendor has left to protect is that of a vendor's lien (an interest somewhat similar to that of a mortgagee), and upon payment of the loss, which cannot exceed the unpaid balance due on the contract, the insurance company will be subrogated to the extent of the amount paid.

If it is desired to protect the interest of the vendee only, the policy should be issued in his name just as if he also held the legal title. It is customary to state in the policy form that he holds a bond for a deed or a contract of purchase, although under the decision this would hardly seem to be necessary.

If it is desired to protect the interest of both the vendor and vendee it can be done by issuing the policy in the names of both and stating therein that the property has been sold under contract by one to the other and making loss, if any, payable as their respective interests may appear.

A policy issued to the vendor setting forth the fact that the property has been sold under contract to the vendee (naming him) and making loss, if any, payable to each as their respective

interests may appear, would probably be held to indicate an intention to cover both interests, although this is getting the cart before the horse and would be analogous to issuing a policy in the name of the mortgagee with loss, if any, payable to the mortgagor. If both interests are intended to be covered the policy should so state.

A policy issued in the name of the vendee in possession with loss if any payable to the vendor, as his interest may appear, with a mortgagee clause attached is the best protection that the latter can possibly have.

Some forms contain a stipulation that the policy shall not be invalidated if contracts for sale of the property are executed and delivered. This will save the policy from forfeiture, but it will only cover the remaining interest of the vendor.

Several years ago the

UNIFORM BILL OF LADING

was adopted by railroads and other transportation companies, with the endorsement of the Interstate Commerce Commission acting in an advisory capacity. It contains one provision of special interest to insurance companies, which reads as follows: "Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance." The insertion of the closing words of this last paragraph was secured through the efforts of marine underwriters, who lost no time in preparing suitable clauses to counteract the effect of the insurance provision.

From the various warranties prepared by marine companies to meet the situation the following have been selected:

"Warranted by the insured free from any liability for merchandise in the possession of any carrier or other bailee who may be liable for any loss or damage thereto, and any stipulation or agreement that such carrier or bailee shall have the benefit of this insurance, shall void this policy or contract of insurance. Also,

"Warranted by the assured free from any liability for merchandise in the possession of any carrier or other bailee who may be liable for any loss or damage thereto; and free from any liability for merchandise shipped under a bill of lading containing a stipulation that the carrier may have the benefit of any insurance thereon; and that any insurance against fire granted herein shall not cover where the assured or any carrier or other bailee has fire insurance which would attach if this policy had not been issued."

Fire insurance companies have apparently taken no action in this direction, and unless they do so the insurance issued by them will inure to the benefit of the carrier.

The recent action of the New York Insurance Exchange in abrogating the old pattern clause and requiring patterns, models, molds, matrices, drawings, designs, dies, solutions, photographic negatives or lithographic plates or stones or engravings thereon to be specifically insured, and in preparing a clause precluding the possibility of their being covered by general terms under other items of the policy, was a move in the right direction, and the rule should be universally adopted not only as a matter of sound underwriting practice, but in the interest of convenience in adjustments and as a matter of simple fairness between the insured and the company. All of the articles mentioned are of uncertain value and belong in a class by themselves; and to include them with machinery and fixtures, the value of which is easily ascertainable, invariably complicates the adjustment, especially when the policies contain the full co-insurance clause with no limit on the articles in question, for the oldest adjuster present never heard of a poor horse (insured) ever being killed by lightning or a dead pattern ever being destroyed by fire.

A case is now pending in a distant city under the following conditions: Blanket policies for over \$150,000, full co-insurance clause, and no limit on patterns. A comparatively small fire occurred in the basement of one building belonging to the plant which was used for the storage of patterns and drawings. If the fire had occurred in some other part of the plant the probabilities are that in figuring value for purposes of co-insurance the basement of the burned building would have been regarded as a sort of pattern cemetery, but through the revivifying influence of the fire the patterns and drawings therein instantaneously assumed a valuation of about \$50,000, or about one-third the value of the entire plant and contents.

In naming a specific amount on patterns, etc., the company knows just what it is doing and just what to expect; in insuring them blanket without limit, it ought to know from experience what to expect, although it does not know just what it is doing.

The precaution taken by the framers of the pattern clause to avoid having patterns and other kindred articles covered by general terms in other items of the policy, directs attention to the fact that in preparing any kind of form special care should be taken to have each item embrace exactly the property intended to be protected by it, and neither by general or specific terms have the same property covered under more than one item. As there are a number of exceedingly broad general terms, such as "supplies," "appurtenances," etc., they should be used exactly where intended, and not elsewhere.

Among the new elements which have been introduced into policies of fire insurance during the past thirty years, by far the most important is that of co-insurance, which has its practical manifestation in various forms familiarly known as the "80 per

cent. co-insurance clause," "the percentage average clause" and the "reduced rate average clause." Co-insurance is fundamentally sound in principle and an absolutely necessary factor as an equalizer of rates; and although by some strange providence it almost invariably happens that the relative sound value of property saved is much less than that destroyed, yet the co-insurance or average clause, by maintaining a proper relation between sound value and loss, operates in a large measure as a sort of automatic regulator in loss adjustments.

Co-insurance or average conditions, if a proper amount of insurance is carried, are in themselves perfectly harmless, but if used in connection with the average distribution clause, special care should be taken by the insured or his broker to see that all policies are strictly concurrent and that all contain the average distribution clause, for if some contain the clause and others do not the insured may be compelled to stand a portion of the loss himself, notwithstanding the fact that the aggregate insurance may exceed the aggregate value. All the policies should contain the average distribution clause, or none of them should.

Policies are sometimes issued to John Doe and/or Richard Roe, loss if any payable as interest may appear. This will cover the described property such as may be owned by each individually or by both jointly, and in event of loss to both interests the sworn statement in proof should, of course, be executed by both and draft in payment issued to both; and in event of loss to one interest only, the sworn statement should either contain or be accompanied by a statement from the other, that he has no interest in the property for which claim is made. In the absence of such a statement or release the insurance company, as a matter of self-protection, will be under the necessity of making loss draft payable to the order of John Doe *and* Richard Roe, even though one of them may have no interest in the claim, in the same manner that it does to the insured and mortgagee in the absence of a release from the latter.

When the insured has, prior to issue of the policy, released a railroad company or wrongdoer from liability for fire from negligence or other cause, and fails to advise the insurer of such release, has he concealed or misrepresented any material fact or circumstance which precludes his recovery from his insurer? Or where he has, by his own act, deprived the insurer of its subrogation rights, is it a good defense to an action on the policy?

In England, in the case of *Tate vs. Hyslon* (1884), 15 C. B. O., 3688 Eng., the Upper Court reversed the finding of the Lower Court and held that when the insured released the common carrier from liability (except negligence) and knew or should have known that the underwriters charged a higher premium on goods carried under such conditions, the insured's failure to disclose

such release would (and in this case did) defeat recovery from the underwriters.

There are a number of American decisions bearing on the subject, among which may be mentioned the following:

Greenwich Ins. Co. vs. L. & N. Ry. Co., Ky., 1902, Vol. 31, Ins. Law Journal, p. 298.

Pelzer vs. St. Paul F. & M. Ins. Co., U. S. C. C., 19 Ins. Law Journal, p. 372;

Pelzer vs. Sun Ins. Office, South Carolina, S. C., 21 Ins. Law Journal, p. 952;

The courts of this country have not been as generous to the underwriters as the English courts, but from an analysis of the decisions we feel warranted in drawing the following conclusions, viz:

Such agreements are valid if there is a proper consideration therefor, and they are not against public policy.

When the insured has, *previous to the fire, and before the issue of the policy*, released the railroad company from liability and neglected to disclose such fact to the insurer when applying for insurance, it is a question for the jury to decide whether the failure to make such disclosure was concealment of a material fact, and where the insurers discriminate against property subject to such release to the extent of charging a higher rate, and this fact is known to or brought home to the mind of the insured, and he fails to pay the higher rate and have notice of release endorsed on the policy, there would be a reasonable chance of defeating the claim on this ground, but where there is no such discrimination on the part of the companies it would seem that the insurer would have no hope of a successful defense.

When *after the issue of the policy* the insured enters into a contract with a railroad company agreeing to hold it harmless from any liability for loss by fire there can be no recovery against the insurer. (Down's Farmers' Warehouse Association vs. the Pioneer Mutual Insurance Association, Washington, S. C., 35 Ins. Law Journal, p. 273.)

It is the practice of insurance companies to make an extra charge of from 5 to 15 per cent. of the annual premium for a waiver of this subrogation right, and, notwithstanding the well known inclination of the courts to favor the insured, it would be the part of wisdom for him to pay the additional premium and be fully protected by having the following indorsement made on his policies: "Notice is hereby acknowledged that the insured has waived his right of recovery from _____ Railroad Company for any damage by fire occurring to the property hereby insured."

USE AND OCCUPANCY AND PROFITS.

There are two kinds of insurance which have in recent years become quite popular, viz: Use and occupancy insurance, and profit insurance.

The phrase "use and occupancy" is somewhat vague and indefinite. It usually involves the idea of earnings or profits, but they are not necessarily synonymous terms. Use and occupancy insurance is analagous to rent insurance or profit insurance, but it is broader than either, as the insurance companies discovered in the Buffalo Elevating Company case several years ago (Michael vs. Prussian National Ins. Co., 171 N. Y., 25), where the court permitted the insured to collect over \$60,000 for an alleged loss of use, a large part of which was not really sustained, for the insured, as members of a pool composed of many elevators, was by agreement to receive (and subsequently did receive) their full share of the pool earnings in spite of fire destroying the elevator in question.

Use and occupancy insurance is adapted more particularly to manufacturing risks; insurance of profits, rents, rental value and leasehold interest to mercantile risks, although it is customary for manufacturers to take out profit insurance on finished goods sold or contracted for. Use and occupancy insurance and profit insurance should not be written except for concerns of the highest standing doing a profitable business.

There are many use and occupancy forms in current use; some limit the liability of the insurance company to 1-300 of the amount insured for each day of total prevention, on the theory that 300 days constitute the average working year; others limit the company's liability to the proportion of net earnings that the amount of the policy bears to the average net earnings for the twelve months immediately preceding the fire; others name a limit of *not exceeding* a stated amount per day, the said limit usually being 1-300 of the amount of the policy; and all provide for ratable payment in event of partial prevention. All such forms are eminently fair, both to the insured and to the company.

Some use and occupancy forms expressly stipulate that settlement, in event of loss, shall be on the basis of a fixed amount per day, and the fact that there may be differences of opinion as to what items or factors should properly be taken into consideration in arriving at the net profits affords some excuse for making the policy a valued one, notwithstanding the general objections to valued policies.

Under any of these forms, however, the amount of insurance written or permitted should not exceed the net profit for the preceding year, as shown by the books of the insured.

AN EXAMPLE.

In a Western city, some months ago, a comparatively small fire occurred in the finishing department of a plant consisting of sixteen buildings, and, on the basis of the expense account, this department constituted about 7 per cent. of the entire plant. The use and occupancy insurance, which did not contain any element

of co-insurance, amounted to about 35 per cent. of the annual net profits. The adjusters figured the actual loss at less than \$1,000, but claim has been made for about \$36,000, or \$9,000 per day, just as if the entire plant had been thrown out of commission instead of a small fractional part thereof, and that department the one which of all would discommode the insured the least. The loss has not yet been settled, but the fact that such a radical difference of opinion could possibly arise in regard to the construction of the words, "the production of finished goods," shows that too great care cannot be exercised in the preparation of forms connected with this unexplored branch of the business.

When insuring commissions and/or profits the form should limit the liability of the insurer to not exceeding a certain percentage on the sound value of the stock, and it should also contain a stipulation that the loss on commissions and/or profits shall not, in any event, exceed said percentage of the amount of damage which the merchandise itself shall be found to have sustained, irrespective of whether said damage be ascertained by agreement, by appraisement, or whether the stock is surrendered to the companies insuring same, and the net loss ascertained through sale of the salvage.

The policy should also be subject to average or co-insurance conditions.

Use and occupancy and the kindred subjects of rent, rental value, leasehold and profit insurance, if fully considered, possess in themselves sufficient material for a special paper.

MARKET VALUE CLAUSE.

The following "market value" clause is now frequently used in connection with lumber risks:

"It is understood and agreed that in event of loss or damage to lumber the basis of settlement and application of the average or co-insurance clause shall be the market value at _____ the day of the fire, less cost of transportation and marketing at the time and place of fire."

The following is used in policies covering on stock in tanneries:

"It is understood and agreed that in the event of loss or damage to the property hereby insured, the basis of settlement on tanned leather, finished, unfinished or in the rough, shall be the market price of similar leather in Boston, Mass., the day of fire, less cost of finishing and transportation."

Somewhat similar clauses are inserted in policies covering on whiskey, sugar and other staple products in the hands of a manufacturer.

The Supreme Court of Michigan, in 1892 (Mitchell vs. St. Paul German Ins. Co., 92 Mich., 594), and the Texas Court of Civil Appeals, in 1898 (Hartford Fire Ins. Co. vs. Cannon), de-

cided that the basis of indemnity for lumber is the market value. The Supreme Court of Pennsylvania had decided that the "actual cash value" of sewing machines was the cost to the insured, who was a manufacturer, to reproduce them. (Standard Sewing Machine Co. vs. Royal Ins. Co., 201 Pa. State, 645.) But when the same court ran up against whiskey, because of the peculiar nature of that commodity, it staggered and fell into the market value column. (Frick vs. United Firemen's Ins. Co., 218 Pa. State, 409.)

The United States Circuit Court of Appeals followed with a similar decision (Mechanics Ins. Co. vs. C. A. Hoover Distilling Co., Vol. 40, Ins. Law Journal, p. 347), so that unless the parties to the contract agree that the words "actual cash value," and "cost to replace," as applied to goods in the hands of a manufacturer, shall be construed to mean "cost to reproduce," there appears to be no good reason why the market value clause should not to be used in policies covering on lumber and whiskey at least, for it is more than probable that other jurisdictions will follow the precedents already established, and that the companies will be under the necessity of settling future losses thereon on that basis, whether the policies contain such a provision or not.

To just what extent the judicial inclination may feel impelled to go in favor of market value as applied to goods in the hands of a manufacturer, in construing the New York Standard Policy remains to be seen, but in the meantime the market value clause should not be inserted in policies issued to manufacturers except on risks where the companies would, if liability were limited to cost of production, be perfectly willing to write profit insurance. After all, the difference between having cost of production and profit merged in one set of policies and having policies covering each separately is not very great; in fact, in principle, the difference is the same as that between blanket and specific insurance, and in cases where insurance of both cost and profit are not objectionable, the terrors of the market value clause would be in a large measure neutralized by average or co-insurance conditions, and no such risk should be written unless subject to such conditions.

It would be interesting to consider forms covering common carrier liability, improvements and betterments, leasehold interest, mortgagee's interest, rents, rental value and reinsurance; also clear space, iron safe and three-fourth value clauses; policies issued to heirs, administrators, estates, etc. But it was difficult enough to know where to begin this subject, and it is still more difficult to know where to stop.

VITAL POINTS IN FORMS.

In general, policy forms contain many superfluous words; for instance, in that relic of the past commencing, "On household and

kitchen furniture, useful and ornamental," five words out of the eight are unnecessary, and in that other inheritance from our ancestors reading, "On merchandise, hazardous, non-hazardous and extra hazardous," six words out of the eight are redundant, and the same criticism will apply to a large majority of the forms in current use. The longest form may afford the shortest indemnity, and a good form can be very materially weakened by the injudicious addition of words, although it is better to use too many than too few. Vital points should be covered and useless phrases omitted. The three graces of the ideal insurance form are clearness, conciseness and completeness.

One of the best things in the New York Standard Policy is on the back of it—"It is important that the written portions of all policies covering the same property read exactly alike. If they do not, they should be made uniform at once." If proper attention were given to this admonition, the vocation of the apportionment expert would be gone and some of the troubles that now vex us would be at an end.

FORMS; FROM THE BROKER'S STANDPOINT.

Prominent Broker Points Out the Importance of Correct Description of Property Insured.

By Julian Lucas, Jr., Vice President, Davis, Dorland & Co.

If I were asked the question, "What is it that makes a broker necessary in the field, and why is it not practicable for the insuring public to deal direct with the insurance companies?" my reply would be, "because of the vital necessity for his services in drafting proper forms in policies of insurance." Insurance brokers are presumed to be thoroughly familiar with the conditions of the Standard Policy, especially those conditions which have been the subject of judicial construction, and to have that special training which is so essential to the drafting of contracts of insurance.

Fire insurance policies frequently are the only thing that stand between the merchant and financial ruin. Yet you will see property of considerable value insured under forms that have been the product of the mind of some stationer, purchased by the broker at so much per dozen, or the output of the supply department of some insurance company, most of the latter type being a relic of the time before we had a Standard Policy, containing such obsolete expressions as "hazardous" and "extra hazardous" with few, if any modifications of the conditions of the policy to meet modern business conditions and the special requirements of the assured, and no two companies having forms at all identical in phraseology. Brokers are inclined to the belief that knowledge of policy forms and conditions should not be the exclusive asset of loss departments but that underwriting departments as well should be thoroughly familiar with the subject.

What do you suppose would be the conditions disclosed, on the average printing risk, after a fire, if the insured saw fit to place insurance direct with the various companies? He would probably have a collection of contracts, non-concurrent and conflicting in their terms. A fire would reveal a considerable number of machines purchased with a chattel mortgage existing thereon, without any provision in the policy therefor; a number of ma-

chines leased without any "property of others" clause; some purchased under contract, the ownership of the machines remaining with the seller until final payment; in other cases you would probably find that the seller, while vesting the title in the purchaser, had insured the machines for joint account, with no provision excluding machines on which there was specific insurance. The employment of several brokers on the one risk frequently results in a similar exhibit of non-current and conflicting contracts.

In my early career in the insurance business very little attention was paid by the average broker to forms or contracts, and policies were issued and premiums paid with little or no thought given as to whether or not the client was properly protected, and with absolutely no idea of any legal liability on the part of the broker. In those days the broker had little or no technical knowledge. Conditions, however, have changed, and today the broker has a keen realization of his responsibility to his clients. The courts have held, as a matter of law, that a broker is presumed to have the requisite knowledge, skill and information to properly protect those clients who have entrusted their interest in his hands.

LIABILITY OF INSURANCE BROKERS.

In the State of Pennsylvania, judgment was given for the sum of \$136,000 against insurance brokers for negligence, in that they, the brokers, having knowledge of the existence of a chattel mortgage, did not make proper provision therefor in the contracts. This case was reversed, however, in the United States Circuit Court of Appeals, on the ground that the evidence was not sufficient to charge the insurance brokers with negligence—see *Fries-Breslin Company vs. Bergen & Snyder, Ins. L. J. Vol. 38, P. 1216*.

The Court of Appeals of Kentucky held "Where the insurance broker or agent procures for and delivers to an assured an unlicensed, non-admitted insurance company's policy, the broker or agent is liable for the loss. It is not necessary for the broker to make false or fraudulent representations concerning the company, or its solvency. If, in fact, it is insolvent, or fails, or refuses to perform its contract without legal excuse, the broker is liable."

In this State, in *Burges vs. Jackson*, 162 N. Y. 632, the court said: "The defendants, by holding themselves out as persons constituting such firm, engaged in the business of effecting insurance, assumed to have the requisite knowledge, information, ability and skill to accomplish such purpose in behalf of those who should become their patrons. They are not insurers of the adequacy in financial conditions of the companies from which the policies were obtained through their advice and agency, but

in whatever they did in that respect for others they undertook to use reasonable care, skill and judgment, with a view to the security or indemnity for which insurance was sought."

Frequently disputes and disagreements arise in connection with the adjustment of fire losses, and I am frank to admit that in my opinion most of them are due to the carelessness displayed by the broker in the drafting of the contract; to his failure to make proper inquiry into facts and circumstances of the individual risk, or his entire want of the requisite technical knowledge and training.

No excuse for lack of technical knowledge on the part of insurance men can now be urged with such an institution as the Insurance Society of New York. I recommend it especially to the younger men who have any serious idea of making the study of insurance their life work. Our business has become a technical business, if not a profession. Those of you who think this business is not a serious one, and hope to be successful by merely hitting the high places, are making a very grave mistake. No man can be a successful insurance broker or, indeed, a successful insurance man without an acquaintanceship with forms and contracts and the court's interpretation of its various clauses.

If I had my work to do over again, one of the first things I should do would be to memorize the Standard Policy of the State of New York, every line of it. After memorizing, I would sit down, study and consider every clause. I would endeavor to determine what its framers had in mind in adopting its particular clauses and conditions, and I would know what the leading writers of insurance had to say thereon and what construction the courts had given to its various clauses. Such information can only be obtained by most diligent and earnest work, and I know of no better source or medium through which to acquire knowledge on this line than through membership in this society, attendance at its lectures and a diligent use of its library.

FIRST IMPRESSIONS OR GUESSES

on interpretations of clauses of insurance policies, in my experience, are almost invariably wrong. Illustrating this, I would call your attention to the decision of the Court of Appeals of this State in the case of "Houlihan vs. Preferred Accident Insurance Company." The policy insured the beneficiary against external, violent and accidental injury "if caused by the burning of a building while said person is therein." The beneficiary was burned to death by a fire which occurred in the house where she lived. There was considerable fire but with little damage to the building. It would seem to the average insurance man that the test of liability in this case was whether or not the beneficiary's death was caused by an accidental fire in the building. In fact, the Appellate Division of the Supreme Court of

this State so held. However, upon appeal, the Court of Appeals held that it was the burning of the contents and not the burning of the building that caused the accident, and, consequently, the company was not liable.

While this is not a fire case, it illustrates the necessity, when studying insurance contracts and clauses, of giving them most careful thought. This would indicate that it is not altogether certain that the courts will rule in favor of the insured when the contract is ambiguous or susceptible of two interpretations. It also illustrates the danger of insurance brokers making innovations in the form of new or "catch" phrases, trusting that the courts will interpret them as they believe they should be interpreted.

Too much credit cannot be given the framers of the Standard Policy considering the radical changes in business conditions during the last twenty-five years and the few modifications which are necessary to meet those changes. Any attempt to revise the conditions of the Standard Policy would be a serious mistake, but I do feel, however, that this can only be avoided by permitting the broker or agent very wide latitude in the drafting of policy forms. You cannot convince me that a "form is going to burn a risk." Under the system of schedule rating, proper charges are made for all hazards and faults of management, and the co-insurance clause provides that the assured collects only that percentage of his loss that his insurance bears to value. Of course, I am speaking broadly lest some of you may get the idea that the 80 per cent. clause only pays 80 per cent. of the loss.

It is not practicable for underwriters to adopt uniform forms and enforce their employment on all contracts of insurance. Possibly so in case of household furniture and dwellings, but surely not in cases of our large industries, consisting of many different types of buildings, with numerous and distinct hazards requiring special description, and many modifications of the conditions of the policy.

UNCONDITIONAL AND SOLE OWNERSHIP.

In drafting forms of policies, we first consider the title or person insured under the contract. If the assured's interest is other than unconditional and sole ownership, or if the subject of insurance be realty, and the property is held other than in "fee simple," it is fatal to insure the party interested simply as "owner."

The "unconditional and sole ownership" clause of the Standard Policy has been a frequent subject of judicial construction. Brokers do not realize that an insurance policy is a personal contract; that it does not follow the property, and, as a matter of fact, does not really insure the property at all. It agrees to in-

demnify the owner for loss or damage by reason of fire to certain described property at a specific location. If the ownership be anything short of sole or unconditional, it is essential that the exact interest, whatever it may be, is stated in the policy in clear and concise language. You cannot insure property of a firm in the name of an individual partner, the property of a wife in the name of the husband; nor can you insure property in which you have no legal or equitable interest.

It should require no great amount of intelligence to make such inquiry of an assured as to ownership as would disclose immediately whether the ownership was unconditional and sole ownership, or what might be the real interest in the property of the party desiring the insurance. I can hold out but one opinion, and that is, that most litigation arising under this clause of the policy is due to absolute negligence on the part of the broker in not making proper inquiry.

It is entirely proper to insure real property in the name of "the estate of," but my experience as to personal property, such as household effects and stock and machinery, is that such method of insuring is apt to result in complications. I am rather of the opinion that only such property as came down with the estate would be covered under this title, and that any new household effects, or new stock, or machinery acquired could not be held to be covered under the expression "Estate of." Policies should be drawn in the name of "the estate of" and the individual heirs as their interest may appear.

DESCRIPTION OF PROPERTY.

The ideal method of insuring from the standpoint of the insured would be a simple contract reading "On building and contents," with a clause to the effect that such property, liability for which must be specifically assumed under lines 39 to 41 of the policy, is also covered under this policy. However, existing conditions preclude this method, for the principal reason that generally buildings are rated lower than contents, and in order to blanket buildings and contents the assured would have to pay the contents rate. So, for the purpose of this discussion, the forms will be considered as specific on building, specific on stock and specific on machinery.

In the making of a building form it has been the practice to enumerate in the buildings item such articles as engines, boilers, heating, ventilating, lighting and electrical apparatus, elevators, etc., and all permanent fixtures to the building. No doubt this custom is due to the fact that in a large number of instances the courts have held these particular items to be permanent fixtures to the building. It seems to me that this method is the correct one.

MACHINERY ITEM.

Our method in drafting the machinery item of the form is to employ the general expression "Machines, Machinery, Tools, Implements, Apparatus, Appliances, Furniture, Fixtures, Signs, Awnings, etc.," endeavoring as far as possible to employ general language and refrain from any restricting or qualifying terms or phrases. There should be, however, a clear dividing line between machinery enumerated under the building item and the machinery insured under the machinery item. Our method is to employ the following expression: "It is understood and agreed that property specifically enumerated under the building item is not considered as covered under this item, namely, 'machinery item.'" I do not approve of such expressions as "Fixed and Movable Machinery," because, to my mind, it is a very difficult proposition to determine as to what constitutes "fixed machinery" as distinguished from "movable machinery," nor do I approve of the use of such expressions as "used in the business" or "machinery appertaining to the business of —." Conflicition between the building and machinery item is more apt to happen in connection with such articles as shafting, belting, pulleys and hangers, and it has been common to find these articles insured under both items.

STOCK ITEM.

In the construction of a stock item in a manufacturing plant there seems to me to be but one correct method of describing the property insured, namely, "On stock, samples, materials, boxes, cases, labels and supplies, manufactured, unmanufactured and in process of manufacture," without any restricting or qualifying clauses or phrases as to the kind of stock. In the case of a mercantile risk, our method of description is as follows: "On merchandise, samples, materials and supplies," without any restricting phrases as to the class of merchandise.

We have now to consider the "commission" and "in trust" clauses usual to stock and merchandise forms, namely, "Their own, or held by them in trust or on commission, or sold, but not delivered or removed, or for which the assured may be liable, and the property of others on storage or for repairs." These phrases, of course, are for the purpose of bringing under the protection of the policy the property of others in the care and custody of the assured for which he desires protection.

Since the decision in the *Utica Canning Company vs. The Home Insurance Company*, 116 N. Y., Sup. 934, where it was held that the words "in trust" included all property in the care and custody of the assured, regardless of his liability, some of us have come to a radical change of opinion as to the desirability of employing the phrase "in trust" in policy forms. Having in mind the operation of the co-insurance clause, you can appreciate

how dangerous this clause might be in the case, for instance, of printers, laundrymen and finishers, who at times have property of others to a very considerable amount on their premises for which they are not legally liable and which they never contemplated should be covered under their contracts. If no goods are held on storage or for repairs the best expression to my mind is the following: "Their own, or the property of others for which they may be liable." Of course, this latter clause also should be applied on policies insuring machinery. If there be property of others held on storage or for repairs you understand that it is essential that it be noted in the policy.

LOCATION OF PROPERTY.

The usual custom is to employ the expression: "Contained in and on buildings, additions and extensions situate at a given location." Of course, we frequently see contracts which read not only "in" and "on," but also "about" the buildings, additions, extensions and sidewalks. In one case in my experience where the expression "about" buildings, additions and extensions was employed, a fire disclosed that there was about \$175,000 worth of property contained in the yards. So you will see that it is almost impossible to adopt or lay down any general rule. Each individual risk must be treated separately, values and their location looked into very carefully, having in mind the amount of the insurance and the operation of the co-insurance clause.

"It is understood and agreed that this insurance shall cover the assured as now or hereafter constituted." This clause would protect the assured against changes in a firm or partnership, the standard policy providing that any change in the interest, title or possession voids the policy.

The Court of Appeals in this State in the Germania Fire Insurance Company vs. The Home Insurance Company, Ins. Law Journal, Vol. 24, p. 328, held that: "A policy provision rendering it void in case of any change in title or possession is voided by the single party insured taking in a partner," and I might add in this case that the new partner was given but a three-tenths interest in the business.

"It is understood and agreed that this policy shall not be invalidated should the building stand on leased ground." The standard policy provides that if the subject of insurance be a building not held in "fee simple" the policy is void. Most of you appreciate that there are many thousands of dwellings and other buildings in this territory standing on leased ground, and that it is a rather dangerous proposition to issue a policy without such a clause.

"It is understood and agreed that this policy is to be considered

a devisable and several contract, as if separate policies were issued on each building and contents." In view of the fact that the standard policy provides that in the event of a breach of condition that the entire policy shall be void, I am of the opinion that a clause somewhat similar to the above should be employed on all schedule forms of contracts, and surely on all floater contracts covering a number of separate and distinct risks.

I appreciate that there are decisions as to the effect that a policy is devisable where different classes of property are insured under separate items with a specific valuation, nevertheless the law is far from settled. If there be no separate amounts on the different classes of property and the policy is written for one gross premium, a breach of a condition affecting part of the subject matter only voids the entire policy.

The standard policy provides that "if a building, whether intended for occupancy by owner or tenant, be or become vacant or unoccupied, and so remain for ten days, the policy is void." The courts have held that even though the building, after having been unoccupied for a period greater than ten days, again becomes occupied, and a fire occurs during the reoccupancy, the assured cannot recover. Of course, this is on the theory that a policy is not merely suspended, but absolutely voided, requiring the coming together again of the parties interested, in order to revive the contract; consequently, the importance of a clause permitting vacancy or unoccupancy is seen.

"It is understood and agreed that particular machines or any other article or property above enumerated, on which there is specific insurance, are not covered by this policy." This is an essential clause, its purpose being to guard against the confiction of insurance, specific on particular machines or articles, with the insurance covering the general plant.

"It is understood and agreed that the existence of bonds and/or mortgages covering in whole or in part the above described property shall not invalidate this insurance." This is an essential clause on all policies insuring corporations, as frequently the mortgages securing bonds, cover not only the building, but the general property, which would, of course, include machinery, fixtures and personal property, thereby making a mortgage in part a chattel mortgage.—Fries-Breslin Company vs. The Star Fire Insurance Company, Ins. L. J., Vol. 36, p. 804.

"Privilege to use kerosene oil stoves for heating and cooking; to work Sundays, nights and holidays or not to work." The standard policy provides for working not later than ten o'clock at night, and also provides for the use of kerosene oil for lights only, hence to my mind, these clauses should be part of any form.

"Privilege to use steam and gas for light, power and heat; for existing communications and occupations." These clauses

are more or less in general use and to my mind do not in any way add to the strength of the contract.

PRIVILEGE FOR OTHER INSURANCE.

You are all no doubt aware that lack of such a privilege is fatal to recovery under the standard policy. The Federal Courts have so held, even in a case where the agent, subsequent to the issuance of policy, had been notified verbally by the assured of his having taken out other insurance, and this, in spite of the fact that it was necessary for him to have other insurance in order to meet the requirements of the coinsurance clause.

MECHANIC'S PRIVILEGE.

Employment of mechanics for a greater period of time than fifteen days, is prohibited by the policy, and the employment of the usual "Mechanic's Privilege" is necessary. Of course, where the rules of underwriters permit, we always employ the broad mechanic's permit, namely: "To make additions, alterations, enlargements and repairs, and this policy to cover therein or thereon, as the case may be."

WORK AND MATERIALS.

The standard policy provides that the entire policy shall be void if (and usage or custom of trade or manufacture to the contrary notwithstanding) there be kept, used as allowed on the above described premises benzine, benzole, dynamite, ether, fireworks, etc. Such prohibition, of course, makes it very essential that a "Work and Material" clause such as is now in general use, be employed on all forms, namely: "Privilege to do such work and use such material as are usual in the business of". I have little sympathy with those rules of underwriters' associations which prohibit the use of the word "supplies" in connection with the word "materials" in a privilege of this character, not because I believe it necessary or essential to the contract, but because of the fact that heretofore custom had established its usage, and it is pretty difficult to explain to our clients why we cannot employ the word "supplies." Our explanation leads the assured, in most cases to believe that the companies are endeavoring to secure unfair advantage.

CHATTEL MORTGAGE.

In view of the conditions of the standard policy, that the existence of a chattel mortgage, without a privilege, is fatal to recovery, it is an essential part of the broker's duty, at least his moral duty, before drafting a contract of insurance to make proper inquiry of his client as to whether or not a chattel mortgage exists. You are all aware that in a considerable number of industries, machinery is acquired under what is known as a "Purchase Chattel." It would seem from reading the case of

Fries-Breslin Company vs. Bergen & Snyder, Insurance Law J., Vol. 38, p. 1216, that if a broker had knowledge of a chattel mortgage, or the assured conveyed to him the information that a chattel mortgage existed, and he failed to make proper provision in the contracts, he would be answerable financially, in the event of the company's refusing to pay the loss.

A reference to the authorities indicates that a chattel mortgage must be disclosed. Insuring John Doe, as interest may appear, or making policy in the name of the owner, with loss, if any, payable to John Doe, as interest may appear, does not, to my mind, disclose a chattel.

"It is understood and agreed that contracts of sale may be executed and delivered, and foreclosure of mortgages be instituted, without prejudice to this insurance." Under an executory contract where the vendor has parted with possession, he ceases to be the unconditional and sole owner, and the policy is void; hence, the necessity of a clause of this character. The standard policy provides that if foreclosure proceedings be commenced, or notice given of sale of any property, the policy is void; therefore, it is essential that proper provision be made in the contract to guard against this contingency.

NEW YORK STANDARD LIGHTNING CLAUSE.

We all know that direct loss by lightning is not covered by the policy—that is, where lightning strikes a house or building and simply rends or splits it without fire ensuing, so we employ the standard lightning clause, under which direct loss by lightning is assumed.

ELECTRIC LIGHT CLAUSE.

The electric light clause required by the New York Board of Fire Underwriters is made up of two parts, i. e., the "New York Standard clause forbidding the use of electricity" and the permissive clause granting privilege for its use subject to certificate of approval by the New York Board, and notice of alteration.

The electric light clause is not essential to the insurance contract where at its conception electricity is actually employed for light, power and heat, but in view of the fact that insurance cannot be secured without it being incorporated in the policy, it is essential that its conditions calling for certificate of approval and notice of alterations be complied with.

It will take a Court of Appeals' decision to convince many brokers that this clause is consistent with the conditions of the Standard Policy and not in violation of Section 121 of the Insurance Law of this State.

IMPROVEMENTS AND BETTERMENTS TO BUILDINGS.

Where improvements and betterments to buildings amount to considerable value, and are of such a nature as to enter more or

less into the construction or reconstruction of the building, they should be, in my opinion, insured separately, and the policy should contain a clause to the effect that for the purpose of the insurance, the assured is to be considered the sole and unconditional owner, and further, to the effect that the building policies are not to be considered as contributing insurance.

USE AND OCCUPANCY.

The purpose of "use and occupancy" insurance is to protect an assured, not only against loss of profits, but such items as taxes, interest, salaries of employees, who, by reason of efficiency, the assured is compelled to maintain on his payroll in order to retain their services, and loss of customers who have opened accounts with other parties, a large percentage of whom do not return to trade with the assured.

It would seem, therefore, that there is sufficient warrant for the employment of a valued form of policy, fixing the amount payable at so much per day, in the event of building, stock or machinery being destroyed or the premises being rendered untenable. The policy should provide for a pro rata amount per day in the event of only a partial discontinuance of business. My personal experience having in mind two losses which were practically total as to building and contents, leads me to believe that it is hardly possible for companies to sustain a loss in excess of 50 per cent.

COINSURANCE CLAUSES.

In the discussion of the drafting of insurance contracts, the question of the coinsurance clause naturally arises. Insurance is a basis of credit, and as such basis, insurance of a sufficient amount to properly protect the assured is essential. You and I would not care to extend credit to a merchant who protected his property to the extent of 50 per cent. only, when we were aware that in the event of a total loss he would become bankrupt.

Fire insurance rates are based on the ratio of 80 per cent. insurance to value of property, and in most territories the 80 per cent. coinsurance clause is obligatory. Many insurance brokers, and not a few appraisal companies, make the serious mistake in suggesting to the assured that the correct method of insuring is to take policies to the amount of 80 per cent. of the value of the property instead of the full value.

Legislatures can make no greater mistake than enacting laws prohibiting the employment of the coinsurance clause, because, to my mind, the interests of the business world demand its use.

My views as to the full coinsurance clause are more or less radical. I am opposed utterly to its employment under any circumstances, and trust the time will come when its use is discontinued. It is possible for a merchant to determine before a loss within 10 per cent. of what the actual value of his property may

be; but it is not possible for him to determine the exact value. When a merchant has been carrying full insurance for a period of years, and, in many cases, over-insurance, on which he has paid premium, and when a fire arises and he finds that at that particular time, by reason of not having sufficient insurance, that he is a co-insurer for 5 or 10 per cent. of his own loss, you cannot convince him that such a clause is equitable. To my mind the clause creates a difference or disagreement before the loss actually occurs; it tends to create an atmosphere of antagonism, whereas in loss adjustments company and insured should meet on a friendly ground.

You might ask, and properly so, that I would not expect companies to write blanket insurance with an 80 per cent. co-insurance clause, but blanket insurance could be written, and, to my mind, it would not be reasonable to ask companies to write it, subject to the 90 per cent. coinsurance clause, without reduction in rate. I believe the employment of the latter clause would have a tendency to increase the amount of insurance carried with a consequent increase in premiums received.

HOUSEHOLD FURNITURE FORMS.

In connection with household furniture there are a few important matters which I should like to touch upon; namely, that the words "at not exceeding cost" should not be employed in connection with the insuring of pictures. Provision should be made, in view of a very general custom of purchasing talking machines, pianos or other furniture on the installment plan, that the existence of a chattel mortgage does not invalidate insurance, and that the purchaser is to be considered the unconditional and sole owner of the property. I have settled many household furniture losses, and I have never as yet had an inquiry on the part of the adjuster as to whether or no any of the property was purchased on the installment plan. The form should have a mechanics' permit, a vacancy clause, a privilege for other insurance, kerosene oil stove permit, and a clause excluding pictures and other property specifically insured.

There has been considerable discussion as to whether or no it is advisable to bring under the coverage of the policy the property of "guests." I am of the opinion that it is a mistake to include it, unless there be a limitation of not exceeding a given per cent. of the amount of the policy applying to the property of guests. My opinion is based solely on technical grounds, and I have no hesitancy in saying that it would not give me much concern as to whether or not it was included or left out of the policy. We meet this condition frequently in manufacturing or mercantile losses, where small claims are made for loss or damage to tools or wearing apparel, the property of employees.

"WARRANTIES."

All warranties in a contract of insurance must be true, and their terms must be literally complied with. Thus when an assured warrants to maintain a watchman Sundays, nights and holidays, neglect to maintain a watchman during Sunday would be fatal. I am of the opinion that many a merchant, even though this warranty is contained in his policy, fails to maintain a watchman during the hours of Sundays and holidays, due to the fact that he employs but one watchman and the watchman must spend this time in sleep. Of course, mere temporary absence would not void the policy, but, to my mind, an absence of several hours would be fatal.

In the conduct of a brokerage business questions arise from day to day as to whether it is necessary to indorse policies of insurance by reason of changed conditions in the risk in order to safeguard the insured's interest. This may be due by reason of the introduction of new hazards, change of tenants or the making of new communications, all of which involve the question of increase in hazard. In all cases it has been my invariable custom, where there is no doubt, no matter how slight that doubt may be, to make such an endorsement as will absolutely preclude the possibility of the companies contending that there had been an increase in hazard not provided for in the contract.

"It is important that the written portions of all policies covering the same property read exactly alike. If they do not, they should be made uniform at once." If the full meaning of these words could be inculcated into the minds of the average insurance broker or agent, certainly most of the annoyances, disagreements and difficulties which arise in connection with the adjustment of fire losses would cease. How it is that many insurance brokers, with this admonition daily within their vision, can persistently prepare and forward to their clients conflicting and non-concurring contracts is beyond my understanding. Non-concurrence arises in many ways; by reason of insuring property jointly in the name of two parties, and the same property, or part of the same property, in the name of one party. This creates compound and specific insurance just as much as though there was blanket insurance on wheat and specific insurance on oats. Non-concurrence frequently arises by reason of the fact that one set of policies contain the 80 per cent. coinsurance clause in conjunction with an average or distribution clause, and one set of policies with the 80 per cent. coinsurance clause only, thereby creating blanket and specific insurance. You are all more or less familiar with the many cases of non-concurrence which arise in insuring*merchandise "blanket" under one set of policies and a particular class of merchandise "specific" under another set of policies. Such conditions as these frequently result in a

reduction in the amount of the loss which the assured would otherwise collect and invariably brings down upon the heads of the insurance companies criticism which they do not deserve.

POLICY FORMS OF CASUALTY COMPANIES.

I want to say something before closing in reference to forms of personal accident policies employed by various companies. Those of you who have attempted to keep apace with the ever-changing forms of accident policies cannot but come to the conclusion that the standardizing of these contracts is absolutely essential, and if not done by the companies of their own volition the Legislature will step in and do it for them.

Just let me quote to you from a circular of a well known company, issuing personal accident policies, reading in this wise: "Ever notice the announcement by different accident companies of their 'best ever policies?' Always the same special attention called to their '*exclusive* new frills,' promising payment upon some remote possibility of which, in reality, there is but faint probability and which are of doubtful value."

The double indemnity clause of one prominent company, advertising an especially liberal form of contract, provides in part: "If such injury results as aforesaid, and is sustained in consequence of the destruction of a building by fire while he is therein." If any of the unfortunates who lost their lives in the Asch Building fire had had a contract in this company their heirs could not, in my judgment, have secured the benefit of the double indemnity, for the reason that there was no destruction of the building.

I cannot but feel that the employing of this clause, and others of more or less doubtful value, is not only an injustice to the policyholder, but does the business, as a whole, great injury.

We have seen a tendency on the part of casualty companies, especially during the past few months, to broaden out their employers' and public liability contracts, which has, no doubt, been due to the entering into the field of new companies, and the keen competition resulting therefrom. Nevertheless, I believe and know that there is room for radical improvement, improvement which, to my mind, can only come by the adoption of a standard policy.

LIABILITY POLICY FORMS.

Just a few words regarding liability insurance in connection with the operation of automobiles:

Automobile liability insurance, under the present form of policy, does not follow the car, but simply insures the owner against negligence where the car is under his direction, supervision and control. Of course, the policy would cover if the car was operated by a chauffeur acting within the scope of his employment, but if the chauffeur should be using the car for his

own pleasure, or was engaged in some private enterprise, the owner would not be liable. *Cunningham vs. Cassidy*, 127 N. Y. App. Div., 580.

In other words, it does not make a particle of difference who owns the car or who pays the chauffeur (if there be one), but the real test is under whose control and direction and about whose business is the party operating the car at the time of the accident.

Owners of automobiles cannot rid themselves of liability, or avoid the necessity of insurance, by going through the mental process of presenting the car to a son or some one they think judgment proof, or the equally foolish device of taking out the license in the name of a second party, and then proceeding to operate the car like the real owner, which he is.

I have known of owners taking out insurance in the name of irresponsible parties, in whose name license had been issued, thinking by this method to secure the benefit of the policy and avoid judgment in excess of its limits.

It would seem, therefore, that the responsibility of correct policy forms rests entirely with the broker, and not the companies, and the broker, in all fairness to his clients, who have intrusted such important interests in his hands, should see to it that the policies of insurance accomplish the purpose for which they were effected.

While the drawing of policy forms is one of the vital services rendered by the broker, if, indeed, he has progressed with the times, he must also be able to render expert advice in all matters relating to fire prevention and fire protection; he must be thoroughly familiar with the system of schedule rating; he must be familiar with the hazards peculiar to certain classes of manufacture, and how to eliminate or segregate them; and should a fire occur he must have thorough knowledge of conditions of the Standard policy applicable to loss adjustments, in order that he may represent his client intelligently.

THE ORGANIZATION OF AN INSURANCE COMPANY.

An Address Before the Annual Meeting of the Insurance Society of New York, May 28, 1912.

By Joseph Froggatt, of Suffern & Son, Certified Public Accountants. Formerly Secretary of the United States Branch of the Atlas Assurance Company, Ltd., of London.

Organizing an insurance company is quite a different proposition from that of organizing an insurance office. There are many points, however, so closely related in the two propositions that we will consider the question from the standpoint, first briefly, of the organization of the company, and then, after the company is organized, we will endeavor to outline some of the methods employed in a well organized insurance office. I will confine my remarks to the organization of the business of fire insurance.

Since the first "Fire Office" was organized in London in the year 1680 a great many companies have come into existence, some lasting but a short time, others continuing until circumstances forced them into liquidation; while others have weathered the storms and are still to be found standing behind the credit of this and other countries, staunch, well organized and well managed institutions of which we can all be proud.

As the business of a fire insurance company is to provide contracts of indemnity, and as the absolute need of such protection was the cause or reason for bringing together organizations of this character, it becomes apparent to all of us that the organization of an insurance company should be very carefully arranged on a sound financial basis at the least cost for promotion expenses, and when the preliminary organization has been effected the company should have a manager of known underwriting ability and of sound financial practice.

Some of the companies which have come into existence within our experience have not been "organized," but have been "promoted." These terms, while apparently synonymous, are vastly different in actual practice. There may be a difference of 20 per cent. on \$2,000,000, if a newspaper report recently published is true. This report states that a company is now being

"promoted" which is to start with \$1,000,000 capital and \$1,000,000 surplus. It further states that the promotion expenses are *limited* to 20 per cent. We recognize the fact that no new organization can be formed without expenses, but if the organizers have the true idea or the *mutual* spirit, which is the basic principle of fire insurance, the funds will be conserved to the utmost to provide the indemnity for which the company is being organized.

When the organization, so far as capital is concerned, has been completed it becomes necessary to arrange for the conduct of this important business. The appointment of a manager, who is primarily an underwriter of known ability, is the first step, and he in turn builds up his corps of assistants.

THE IDEAL ORGANIZATION

has at its head a manager who is not only an underwriter, but who is a general executive. His office will be divided into two chief departments—the underwriting department and the accounting department. Many sub-divisions are necessary, especially in larger companies, the underwriting department being arranged by territories, with perhaps an officer in direct supervision and chiefs at the head of the territorial divisions. Under these chiefs are daily report examiners and map clerks.

The accounting department will have the secretary or treasurer in general supervision, with a chief accountant and general staff.

Perhaps a further division is necessary in the way of creating a statistical department, and while it is important that there should be a chief clerk in this division, yet it will be found advantageous to have the department under the general supervision of the chief accountant.

A loss department is also necessary, which is usually in charge of a general adjuster, but this department should be under the supervision or closely in touch with the underwriting manager in general, with the accounting features under the direction of the treasurer.

All departments should "dovetail," and this is a very important thing to remember if your office is to have a system from which you hope to obtain the best results at a minimum of cost. Distinct and independent departments not working in general harmony and under a uniform and well defined system will always tend toward duplication and generally costly disorganization.

Assuming that we now have our interior organization arranged, we are ready for business, and as soon as our special agents have been properly instructed as to the general policy of the company, their territories defined, furnished with line sheets, etc., they set forth to establish the company's agency plant.

I will not attempt to relate the difficulties to be encountered in

planting a new company, but if the company is satisfied to have a gradual and healthy growth, a careful and profitable selection of agents can be made; but if the company *must* have premium income, then the expenses of planting will be heavy, the loss ratio is likely to be disappointing, and the surplus of the company may need a doctor before many years have passed. We are now ready to take up

THE ORGANIZATION OF AN INSURANCE OFFICE

or the methods to be employed in handling the business. Many misleading statements are made as to the profits of the fire insurance business. An abstract taken from the prospectus issued by the promoters of a company now being organized, reads as follows:

"In these days of flimsy investment offers, made by irresponsible people, it behooves every mother's son of us to take good care to put his money where it will be safe and surely profitable."

If it is so easy to extract profits from this business, why worry about system? Why not let well enough alone?

Turning to the report of the National Board of Fire Underwriters for 1910, the last copy available, I find a ten year table of underwriting results, 1901 to 1910, of 175 stock companies, which shows a loss of 1.01 per cent. Of course, this includes the San Francisco conflagration, but such an experience may occur at any time.

In view of these actual results it is necessary to look to the system of conducting this hazardous business and to arrange it so that the most scientific methods may obtain, and see to it that the cost of operation is reduced to the lowest ratio consistent with proper supervision.

A well known and successful manager said to me one day when on this topic, "Froggatt, we can do our best in the selection of risks and yet we can't control the loss ratio, but we can control the expense ratio."

There is much food for thought in that statement.

Now as to a concise yet thorough system for this business.

LET US FOLLOW A DAILY REPORT

from the time it is received at the office and this journey will take us through all of the various ramifications of the business.

On receipt of the daily reports they should be stamped, showing date of receipt. Sometimes a time stamp is also necessary, but only in special cases where reinsurance arrangements call for this protection, or the business is so large in order to insure prompt attention and to enable a check being kept upon the work of the office this is found to be of advantage.

The daily reports are then passed to the desk of the underwriting manager or to the chiefs of the territorial divisions, who immediately run through them and indicate the "specials," after which they are classified and then registered. If the registers are simple in form and a loose leaf system is employed the work can be assigned by territories and registered in quick order, the "specials" receiving first attention. I know many underwriters won't agree with me in this method, but if properly arranged it can be carried out with much advantage to the office in general and without any loss of time in passing upon the daily reports.

As the daily reports for any State are registered they should immediately be passed to the fire record and commercial rating desk, where they will receive attention as soon as they reach that desk and be passed along by States to the map clerks. By employing this method of handling the reports by States and dividing the clerical work so as to get continuous action, the "specials" will be in the hands of the map clerks an hour after the opening of the office, and a steady supply will follow until the dailies are all disposed of. There will be no delay by this method and you have accomplished (1) an immediate record of your business, (2) obviated the necessity of rehandling the daily reports, (3) provided a basis for checking accounts, (4) your daily reports are in your files instead of floating around the office for an indefinite period.

I would suggest that much time will be saved by arranging your office so that the desks at which daily reports are handled are within easy distance of each other.

The daily reports are now in the maps and ready for examination. I am assuming that the map-clerk will have surveys and any other data regarding the risks attached to or with the daily reports, so that the examiner will have everything before him when passing upon the risk. Survey numbers should appear on the maps, and, by the way, if you adopt the system of using vertical files for your surveys with only one pocket for all surveys on each risk you will have but one number to map. Of course, an index to this survey file will be necessary.

The daily reports have now received the proper scrutiny. Some may have to be held in the maps until the ever busy chief has an opportunity to pass judgment upon them; letters have been written to agents as to certain reports, and the reports are ready to be filed.

But you say right here that a number of them must be held for answers to your queries. Well, there is a difference of opinion as to this. I believe the only way to successfully handle the vast detail of a fire insurance office is to have *one* place for daily reports, and that is the regular file. When you have dictated your queries, keep the carbon copy of your letter in your open

file and send the dailies to the place where, if they are needed, they may be found. More time is wasted in hunting and waiting for daily reports than over any other one thing in your office.

Filing should be done daily, and a competent man, not a boy, should have charge of this work. Filing by agencies and States, vertically, I believe to be the best method, and if you will arrange your "dead" file in the same way you will find it very convenient, and in the end the most satisfactory and most economical way of filing.

Insist that daily reports shall not be removed except as needed and returned as soon as action can be taken on them. When reports are removed from the files a card of the size of the report should be substituted, indicating where the report may be found. This will save not only a great amount of time, but will keep the officers in a better humor. The manager won't have to lose his usual poise waiting indefinitely for a daily report, with a telegram before him advising of a serious fire.

We have now followed the trail of the daily report through the office and into the files. We must now return and look into the

METHODS EMPLOYED IN CARING FOR THE BUSINESS

put upon our books. Do I hear some of the underwriting fraternity say, "Now, we are coming to that part of the organization where much money is spent for the least important part of the business." I know this was the feeling some time ago, but every day the importance of *knowing* what the company is doing and not being satisfied to *guess* at it is being recognized by insurance officials. The old idea of waiting until the end of the year and then of approaching the disclosure of actual conditions in the same spirit as one does a prize package, not being sure what we are about to receive, has passed away, and we now want to know daily approximately what we are doing, and when the month closes we expect to have a report covering our true experience.

In order to do this we must have a system, concise yet elastic enough to cover all the ramifications of our business. The records should be arranged so as to automatically produce the various results of our movements and provide a basis for scientific operation of this vast and important enterprise. Competition is keen, expenses are high, making the margin of profit so small that all information obtainable which will give us a clearer insight into the business should be available.

It has been the custom, and still is the method employed by some companies, to let the agents' accounts constitute the basis of their bookkeeping. I believe the books of the company should be so arranged as to provide accurate records of the business against which the accounts of the agents may be checked. The

records of the company should be so arranged that it should be possible to close your books even though every agent should fail to report. I do not advocate actually closing until the accounts are received and audited, as under the agency system many differences between the agent and the company would arise, most of which are disposed of by auditing the agents' accounts before closing your books.

I do think that after the accounts have been checked your records should be so constructed as to constitute the basis for your accounting system and furnish all data for statistical purposes, without further reference to the agents' accounts.

The checking of agents' accounts should be against your gross premium register, and not against your daily reports. The register should be balanced to show the month's business of each agency corresponding to your agency journal. If your register shows the term of the policy and the classification of the risk it will form the basis for your reserve classification and any other data you may need.

I also advocate the discontinuance of the individual agency ledger and of using a combination journal and ledger. This is a great saving of time and may be so arranged as to furnish data for agency and State results, as well as the detail of outstanding balances.

CANCELLATIONS.

In some offices cancelled policies are passed all through the office, but if on their receipt at the office they are referred to the register clerk in order that the fact of their being in the office may be indicated opposite the original entry, the daily reports may then be obtained, and after the accuracy of the return premium has been tested, the daily report can be stamped indicating cancellation, and passed to the underwriting department to be marked off the maps, the policies being retained in the accounting department for credit in agent's account.

REINSURANCES.

This is one of the unsatisfactory and nerve testing departments of a great many offices. It need not be if a system is arranged which properly covers the detail and provides a check upon the prompt binding and completion of the reinsurance transactions. The old fashioned method of indicating by pencil memorandum the amount of reinsurance required and passing the reports to the reinsurance clerk's desk and then "forgetting it" is not sufficient. Here in New York, where so much reinsurance is placed with various companies on the street, it should not be left to the discretion of a clerk as to where this protection shall be obtained. I have known cases where a custom prevailed of leaving such matters to the reinsurance clerk and the

clerk being unable to obtain the covers held the matters open until the following or a later day. This is the responsibility of the underwriter and not the reinsurance clerk. Something might happen over night. Treaty arrangements and other forms of contract are now so common that reinsurances are effected automatically, nowadays, to a very large extent.

The reinsurance transactions should go through the books on an "effected reinsurance" basis. The custom prevails in some offices of withholding the reinsurances from the books until paid. This method is incorrect, as the liability for reinsurance premiums should be shown and the reserve should be credited. Under the "paid" basis January reinsurances are not put through the books until March or April, therefore the net premium writings for January are incorrect. Agency results and State results are also misleading.

LOSS DEPARTMENT.

This department should have charge and maintain a complete record of all matters pertaining to losses. A blotter, or daily loss record, is desirable, as this will furnish the daily estimated losses and provide an index of the losses in numerical order. It is important to have the detail of losses kept so as to be able to see at a glance the current losses at any agency. It is also important that a good system of recording "reinsurances on losses" be established. All amounts recoverable on losses paid should be credited to losses paid account in the same month as that in which the loss is paid. This is not always done, the amount recoverable from the reinsuring company not being credited in some instances to losses paid account until the money is actually received.

The adjustment of losses is handled nowadays much more satisfactorily than was the case a few years ago. Since the establishment of the adjustment bureaus the expenses of adjustment have been materially reduced, and the adjustments are probably made on a more scientific basis. The individual interests of the companies do not enter into the adjustment, and all companies get a square deal and the assured just and equitable settlements.

STATISTICS.

Much more attention is now being paid to the published statistics relating to the business, and in recent years very valuable data has been accumulated. This department of a company is a very important one, as the keen competition of today makes it incumbent upon every manager to be thoroughly posted on the results of his business if he would work out his own proposition successfully. Expenses of operation in various departments must be carefully watched, results on the different classes of business

ascertained and reserves against abnormal conditions maintained, or the ever recurring emergency will not be successfully encountered.

The "trade" and "underwriting" results should be positively ascertained at the close of each month, and the income and the expenses in detail tabulated, so as to be able to make a study of comparative results from month to month and for periods of the year. The fluctuations in the surplus should be known, and the causes clearly defined. If the expense ratio is increasing, the detailed underwriting statement should exhibit the reason. If the loss ratio is steadily increasing a close scrutiny of the loss records by agencies will set forth the particulars even though the cause may be beyond your control.

But to get this information carefully prepared records must be maintained, and the arrangement should be such as to furnish, in addition to current information, the data for the annual statements.

The detail of an insurance office is so enormous that a system providing for the keeping up the work monthly is the only way of avoiding that usual drain upon the strength of the office force in December and January. It also does away with the general interruption of the usual routine, which is the condition prevailing in many offices during those two months.

Do I hear somebody say, "That sounds good, but ——"? Yes! I often hear that, but this is being done possibly by many of you, and to some extent by all. It simply means finishing or completing your work every month, so that when December comes you merely have one month's work to take care of.

Perhaps you think this possible with the exception of your "reserve" statement. I am a firm believer in a *monthly* reserve system. I advocated it as an officer of an insurance company, and have seen it worked out very satisfactorily. It is very little more trouble, but the satisfaction of knowing the reserve at the close of every month just as accurately as at December 31 is very great.

It certainly must be disappointing to the officers of any company to go along from month to month not knowing what are the fluctuations of this important item of liability, and then to discover on December 31 that the increase is far in excess of their calculations. It is too late then to provide for the effect on their surplus. I realize that fairly good estimates may be made as to the changes in the reserve, but an intimate knowledge of the proportions of term business written during past years, and the writings of the current year, must be in possession of the one making such estimate, if a fairly good guess is to be made. The importance of this item of liability is such that the insurance commissioners have seriously considered the advisability of insisting upon a monthly reserve.

I will not go into a further discussion of this question, as I should like to touch upon another item of statistics before I close my talk with you. This is the classification of your business. Much has been done toward establishing uniform minimum rates, and this country is far ahead of any other country in this respect. A tariff lays down a normal rate of premium for certain risks and then adds additional charges for all those conditions which increase the risk. While the increase of risk is thus penalized, the premium rate is reduced wherever the assured introduces better building methods and protects the risk by use of sprinklers. This is a system of classification of risks for the application of certain rates of premium, and the more exhaustive and accurate the classification becomes the fairer will be the distribution of loss, as the making of rates is in accordance with the measure of loss sustained on the various classes of risk. If it were possible to have an ideal system, companies could so distribute the losses over the community that each person would be charged a rate exactly in accordance with his risk, as is the case in life insurance rates. But it is far more difficult to ascertain the correct data on the varying risks of a fire insurance company than is experienced in the life insurance field, where the risk is fairly constant.

But we might come much closer to a fairly equitable distribution of loss were the varying conditions of the fire insurance business better known. This information is buried in the records of the individual companies, and unless a general experience, covering the business of a large number of companies, at least, can be brought together, it will be impossible to even approach this ideal condition.

Classification results of a character are obtained in a great many companies, but in many instances the only information obtained is the amount of premium receipts and the losses sustained under a certain broad classification. No attempt is made to ascertain the average line, the average rate and the burning ratio. I fully realize the varying conditions of similar risks, and know how different the experience may be in different localities on the same class of business, but how are we to test the judgment of the rate compilers if we do not know the average rate and against this the rate of burning? I think the adoption of a uniform classification schedule by the companies and the establishment of a central bureau to which results should be reported annually and from which the entire experience as to average rate, burning ratio, etc., might be ascertained, would prove to be a good step toward a scientific arrangement of rates. This could be done confidentially and without the results of any one company being known to the others, if that is desirable.

So much has been done by the companies in an endeavor to reduce the opportunities for loss by encouraging the enactment

of better building laws, the better equipment of fire departments and in various way teaching the public how to reduce the fire waste, that I am satisfied the officials today must be open-minded in the matter of obtaining fuller information on this important subject of classification.

The details of such a system could not be discussed in one evening, and I am afraid I have now trespassed upon your good nature.

In closing I would like to say one word with regard to the general system of any office. No matter how good the outline of the system may be, unless the officers are vitally interested in seeing that the instructions are adhered to, and, further, that they make it apparent the information is requisite for the proper conduct of the business, the system will not be a success.

I recently discovered in the office of one of our important companies that certain statements containing valuable information had been discontinued. I asked why the compiling of such useful and apparently necessary data was not continued and I was informed that "it was never called for, so what's the use?"

OILS, FATS AND FIRES.

The Hazard of Greases and Fatty Substances, and Their Chemical Properties as Related to Fire.

By Edward Ransford in the Firemen's Herald.

Owing to their tendency to set up spontaneous combustion, and their well known liability to burn furiously and dangerously, oils and fats, whether in their crude state or in their compounds, such as candles, varnish, soap and the like, are looked upon with suspicion by firemen. This suspicion is equally manifested whether these substances are stored or in process of manufacture, for which reason they come under the provisions of whatever ordinance is passed that deals with explosives and combustibles—all the more that any one of them is both explosive and combustible, and this whether the oily substances are animal, vegetable or mineral.

They are composed mostly of three ingredients—stearin, palmitin and olein. At all ordinary temperatures, the stearin, when separated from the other, is solid, although in very cold weather—if, for instance, lamp oil becomes frozen and solidified—the oil and the stearin are partially separated. Fatty substances depend upon the proportions of stearin and olein, which latter is liquid, while palmitin is midway between the two. In the liquid there is more olein; in the solid, more stearin. Not one of the three, however, is a simple substance; each is a compound, into the constituents of which it is needless to enter.

Among the oily compounds is glycerine, although it is classified with the alcohols. In reality it is a product of the decomposition of oil and fats. It has remarkable solvent powers, and dissolves readily the greatest variety of mineral and organic substances. The action of nitric acid on glycerine (much as in the case of the action of that acid in the manufacture of gun cotton) produces the powerful and very dangerous explosive known as nitro glycerine, which, when mixed with porous silica and some other minerals, is called dynamite.

If fat is melted and allowed to harden a mass is formed from which the fluid olein is pressed out, the stearin being left behind alone. The olein thus pressed out is lard oil; the stearin is used

for making candles. It also enters into the manufacture of soap, which is the product evolved in the preparing of glycerine, along with which also comes potassium stearate, and is a true chemical salt, and a combination of natural fats, which, again are composed of stearin, palmitin and olein. A solution of soap with alcohol and added camphor makes the liquid opodeldoc. A soap mixture of oils and volatile alkali ammonia makes a valuable liniment. Each of these preparations tends to increase the risk of fires in drug factories and stores, although fatty or oily substances are not in themselves volatile. As, however, they float upon water when burning, they form a means of spreading the flames to other combustible matter.

All fatty substances when exposed to the air gradually absorb oxygen, and give off carbonic acid. There are some oils which do not become rancid as do others, but absorb oxygen and become dry and hard. These dry oils are called varnish oils from their being so much used in mixing varnish. Of these linseed oil is the most important. These varnishes when colored are used in the manufacture of oilcloth and oiled silk. Drying oils are used in painting, and when mixed with lampblack in the manufacture of printers' ink. Spontaneous combustion often results from the storage and use of these drying oils, because of their rapid absorption of oxygen. More especially is this the case with oily waste that is allowed to accumulate. As the oxygen is absorbed heat is generated, and sets fire to the combustibles—rags, cotton, linen or woollen—that may be impregnated with the oil, and these, being likewise combustible, also burn. The fats, and likewise their base, glycerol, being compounds of carbon, oxygen and hydrogen; have in themselves the same elements as in wood and coal, and are equally, if not even more, combustible. Among these fatty substances must be included wax, which may be used in the manufacture of the finest kinds of soap.

Volatile oils, as opposed to the fixed oils already mentioned, include oil of turpentine, oil of lemons and oil of peppermint. Nearly all possess the same chemical composition. Some, such as oil of turpentine, are more inflammable than others, and, therefore, need more attention and inspection as to storage and handling. When these volatile oils are exposed to the air, portions of them evaporate, but a part combines with the oxygen of the air and forms a resin. Such resins are in themselves highly inflammable, and when the solvent is alcohol, spirit-varnishes are the result; when some drying oil is employed, oil-varnishes are the product. It is these resins which render some ointments and plasters, as well as sealing-wax, more or less inflammable.

Under the same head of fatty substances may likewise be classed (if not strictly, at least for the purpose of this article) caoutchouc (India rubber) and gutta percha—mixtures of several

carbons and in their composition not unlike turpentine oil, each being the milky juice of a tree. Of these, vulcanized India rubber, a compound of sulphur and caoutchouc, is another inflammable, the manufacture and handling of which require extreme care, if fire is to be prevented.

From the above remarks it will be seen that wherever oil or fat or any similar substances which are akin to them enter for manufacturing purposes, there is a danger of fire either from spontaneous combustion or from some other cause. Chemical plants therefore, soap and candle, oilcloth, oil silk, rubber and other factories of that class, as well as their places of storage, even of sale by retail, should be subjects of a "fireworks and combustible" ordinance, as, also, should all such plants as are intended for refining crude oils, animal, mineral or vegetable, or the manufacturing of their products. It is for fire departments and insurance companies to keep a jealous eye over them, and the fire marshals, State or municipal, to inquire diligently into the causes of whatever fires originate in them.

WOOD DISTILLATION.

A Manufacturing Process to Recover Valuable Naval Supplies From Forest Rubbish.

An improved manufacturing process is being introduced in the South by which resin, wood turpentine and pine oil are being extracted from what has formerly been waste wood in the forests. It is an original process, known as wood distillation, and is controlled by its originator. One plant is already in operation and another is nearly ready for work. Both are located in Georgia.

The wood stock is secured from forest deadwood, stumps, etc., and instead of robbing a forest of valuable timber it is cleared of rubbish and is left in an improved condition. The wood is thoroughly dried and is then fed into "hogs" or chippers, which are high-speed machines similar to pulp wood chippers. The chips go to a shredder, from which the material goes in a conveyor to the extractor house. There lump resin dross, which consists of spent filter cotton batting from turpentine stills that is highly impregnated with crystallized resin, is mixed with it, and the mixture is fed into large vertical steam heated steel rendering tanks, together with a distillate solvent, and the whole heated to a temperature of 198 to 216 degrees Fahr.

The vapor from the extractors is condensed in steel condensers and the liquor is pumped to covered steel receiving tanks at the refinery, where it is redistilled and the spent distillate solvent recovered in vacuum stills. The press cloths used in the process are not washed for using again, but are dried, macerated and their contents recovered by distillation, which is more economical than to attempt to wash the cloths for use again.

The whole process is carried on as a closed circulation operation, and none of the liquors are ever contained in an open receptacle. The spent wood is burned under the boilers and, being highly charged, is valuable fuel.

All the main buildings are of fireproof construction, reinforced concrete being used.

The insurance on the plants has just been placed through a New York brokerage house at a most favorable rate, and there is every prospect that this line will develop into one of the large

enterprises of the South, since it produces valuable naval supplies from material heretofore considered as worthless and which is plentiful all through that section of the country.







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